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LIEUTENANT J. P. MULLER

MY BREATHING SYSTEM

BY

LIEUT. J. P. MULLER

(LIEUTENANT ROYAL DANISH ENGINEERS).

AUTHOR OF

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THE AUTHOR'S PREFACE.

It may be a matter of surprise to some that I should add yet another volume to the already lengthy catalogue of booklets on "The Art of Breathing." In justification I must state that my first reason is, that I have hitherto found all such works to be too much of the nature of text-books on the so-called "art"; hence it is now my ambition to bring forward the common-sense book on breathing.

And my second reason is that, notwithstanding the scores of older books on breathing, we still meet thousands of persons who are unable to breathe properly—not only children and women, but even sportsmen, singers and scientific men. And thousands and thousands still die of consumption, notwithstanding the fact that this could be prevented merely by teaching the children proper breathing. There is, therefore, still much to be done in this direction.

If my booklet contains some repetitions, they are only those which are intentional and such as are always allowed in conveying important advice.

I have done my best to write it in the same simple style which has made my former books so popular amongst the general public. I must admit, however, that I fear I may have failed in this respect in the chapter concerning the diaphragm, which contains much professional technicality of language. My only excuse for this is that, during my studies and practical investigations, it struck me that many of the theories of science on that subject were erroneous, and I succumbed to the temptation of proving this to be the case. It has always been my habit to see with my own eyes and think with my own brain, instead of trusting to a long succession of authorities, each of whom has quoted from his predecessor, whilst the original one may have been unworthy of credit.

This book has not been translated from the Danish, but has been written by myself in the English language. It is hardly necessary to say that the diction has been corrected and improved by my good friends, Mr. Ernest Gunton and Mr. H. R. Murray, to whom my Publishers entrusted this work. I take this opportunity of tendering to them my most cordial thanks.

J. P. MULLER.

45, Dover Street,
Piccadilly, W.
April, 1914.

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MY BREATHING SYSTEM

PART I.

CHAPTER I.

WHAT DEEP-BREATHING EXERCISES ARE, WHY WE SHOULD PERFORM THEM, AND HOW.

EVERYBODY knows that without air we should be unable to exist more than a few minutes, but that it is possible to exist for at least a week without water, while people have fasted from food for from forty to seventy days and even longer. Air is a nutriment, therefore, of even more importance than liquid and solid foods; yet it is remarkable that the majority of people devote so much consideration to what they eat and drink and so little to what or how they breathe.

The element contained in the air we breathe which is of prime necessity to our existence is oxygen. Protoplasm, which is the physical basis of life, the substance of which all the cells which form the body are composed, is continually undergoing chemical change, which change of matter is known as metabolism—complex substances are built up from simple ones, which are in turn broken up; the chemical energy of the food brought to the cells is transformed into the energy of motion, heat, etc. Without oxygen, protoplasm cannot exist; and an insufficient supply hinders metabolism. Once this is understood, the reason why metabolic diseases (gout, rheumatism, obesity, anæmia, chlorosis, jaundice, diabetes) are so common is evident.

How then can we inflate the lungs to their utmost capacity? Only by exercise, and by learning, during such exercise, to breathe deeply and in a correct manner. Of course everybody *does* breathe after a fashion, otherwise life would be but a matter of a very few minutes. But few understand how to breathe correctly. We sometimes meet a person who inhales very well, but correct exhalation is comparatively rarely to be found.

Is "Natural" Breathing always Correct Breathing?

I have often read in books on "breathing" that babies and animals breathe quite correctly. There may be some reason in using the term

"correctly," because it is natural for unintelligent creatures to breathe in such a manner, but a baby's breathing is very short and superficial, consisting of 42 to 45 respirations in a minute, even when lying still. And probably everyone has observed what quick and short breaths the average horse takes when running; that, however, means an overstraining, and a premature wearing out of the whole of the machinery. And the average horse is, notoriously, a short-lived animal.

The Evils of Short and Shallow Breathing.

In superficial and short respiration one portion of the lungs is used too much, and thereby overstrained, whilst another part, through disuse, by degrees loses its working capacity. But the destructive effects of short respiration are not limited to the lungs alone. They affect the whole circulation, and, what is worst of all, the heart. It is a well known fact that the need for air is increased by hard physical work or exertion. It is, therefore, obvious that the breathings, if short, must be more rapid and more frequent in order to secure a sufficient supply of air. Scientists reckon that the heart has a tendency to beat 4 times to each respiration. If, then, the respirations of a horse, or of a badly trained athlete, reach the number, say, of 140 per minute—which is not unusual—this means that the heart requires to beat 560 times! But this is an impossibility, and the result will then be a very irregular pulsation of the heart, the one beat stumbling "on the heels" of the other, and violent palpitations. Such an overstrained heart could never last long.

Deep Breathing must be Taught.

We cannot teach animals to breathe deeply, but we can teach the child to do so, little by little, and even the adult human being, who possesses the intelligence which the animal lacks. Then by degrees it will become quite natural to the person in question to take fuller respirations. Such education in breathing means increased strength and vitality of all parts of the body, internal and external, and consequently a fuller and better and longer life. This education is the aim of all so-called deep breathing exercises. In my first book, "My System, 15 Minutes' Work a Day for Health's Sake," I conclude the chapter "*For those devoted to Athletic Sports*" with the following remarks:—

"Many sportsmen, also, upset their hearts because they take no care to breathe properly. At the Olympic Games of 1906, it appeared that nearly all the participants, excepting the Americans, suffered from dilatation or other defects of the heart. Those who carry out My System according to directions will acquire the good habit of inhaling and exhaling deeply, during the exercises as well as immediately after them. The reason why I have been able to take part, for a whole generation, in many and various hard and often protracted contests, without inflicting the slightest injury upon my heart, is because I have always from childhood paid strict attention to correct respiration."

How the average Athlete and Oarsman strain Heart and Lungs.

I once read in a work by a German doctor, Professor Zuntz, that an adult man respires 16 to 18 times per minute. I believe this calculation is quite correct, and it also agrees with the fact that the average number of pulsations of the heart should be 64 to 72 for a man in a state of rest (viz., 4 × 16 to 4 × 18). But this German professor proceeds to state that dur-

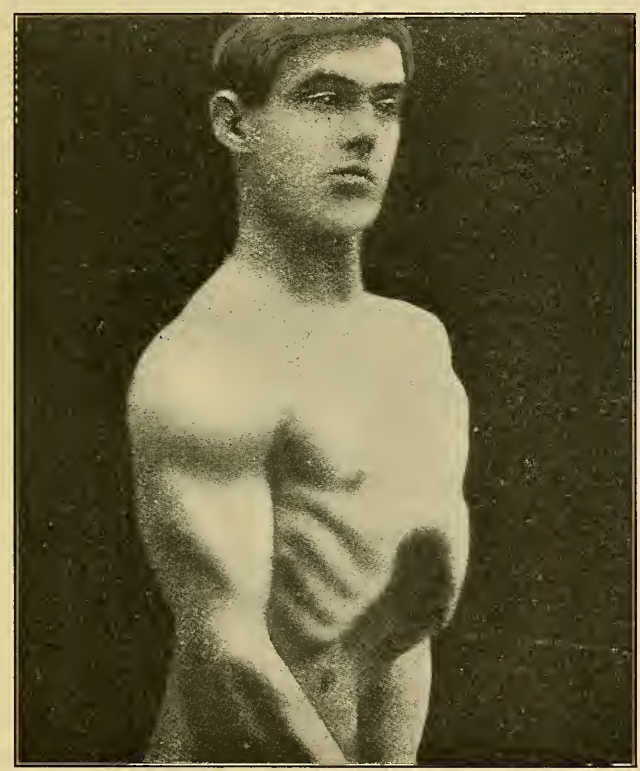


Fig. 1.—A Wrong Method of Deep-breathing.

ing severe exertion this number of respirations would be multiplied several times—for instance, during ordinary walking, 2 to 4 times; while cycling, mountaineering, and running, 9 to 13 times; and while rowing the course at racing speed (1¼ mile in 8 minutes) 20 times. I have seen much faulty breathing amongst athletes, oarsmen and scullers; but if this statement of Professor Zuntz is according to fact, it is much worse than I ever dreamt of. Twenty times 16 is 320 respirations per minute. And this again means that the heart strives to attain 1,280 pulsations per minute! Is it any wonder that so many promising athletes have ruined their hearts and their health?

I am now over forty-seven years old, and have taken part in rowing regattas for twenty-nine years, but hitherto I have never met an oarsman who could pull harder and with more endurance than myself.. The reason is that from an early age I cultivated a full, and proportionately slow, regular respiration, even during the hardest and most protracted efforts. As long as I am under 28 strokes per minute, I take two breaths to each stroke (if racing, of course; during paddling, never more than one breath). But if I make over 28 strokes, I only take one breath per stroke. Therefore the highest number of respirations per minute will be 56. This is vastly different from 320! And the pulsations of my heart, which, according to theory, should strive to reach the number of 224, will practically never be more than 180 even in the hardest spurts. (This number does not, of course, represent a whole minute's work; but, there being 30 beats in the first ten seconds after the finish of a spurt, this corresponds to 180 per minute. A sound heart will rapidly and considerably calm itself down, pulsating at the end of the first 60 seconds at a rate of, say, 160 beats per minute, and at the end of the second minute even only 120.)

The German doctor, Professor Kolb, himself at one time a prominent oarsman, found the hearts of rowing athletes to beat 230 to 250 times per minute after only one minute's hard work. This rate is not so alarming as Professor Zuntz' theoretical figures would lead us to anticipate. But they are still far above the limit of health, and can only be explained by the supposition that the respiration of these men must have been too rapid and shallow.

Why Deep-breathing Exercises have latterly fallen into Discredit.

The question of the usefulness or the harmfulness of deep-breathing exercises has of late been keenly discussed, even in the daily papers. It is very likely that the opponents of such exercises have had discouraging experience themselves, or have witnessed very poor results amongst their friends. I have myself now and then met people whose chest or lungs were defective, notwithstanding that they had worked hard for the purpose of strengthening these important organs of the body. But one thing is quite certain: when deep-breathing exercises have given bad results, then the method has been a wrong one. There are three classes of people amongst whom we may be sure of meeting the inelastic "cropper chest," veiling an incipient or already developed emphysema or even heart disease. Let me cite the cases of the Swedish gymnasts, of whom I shall have occasion to speak in a later chapter; the victims of military drill; and the so-called "strong men."

One of the most common regulations for soldiers is: Chest outwards, "stomach" inwards!—the tight belt, or the officer's corset, helping considerably to secure this unnatural posture. When soldiers are drilled, they are exhorted to arch the chest more and more, and to keep this up permanently. That is called deep-breathing exercise! And the officers think

it their duty to set the soldiers an example. They hardly dare to make a fair exhalation, for fear the chest should sink. By the time, therefore, the lieutenant becomes colonel or general, or even before, his ribs have grown fixed and rigid, the vesicles have become slack and permanently distended, like old misused indiarubber; in other words, his lungs are ruined.

We see here the result of two distinct faults: firstly, the strongly indrawn abdomen, as a result of which the viscera prevent the diaphragm

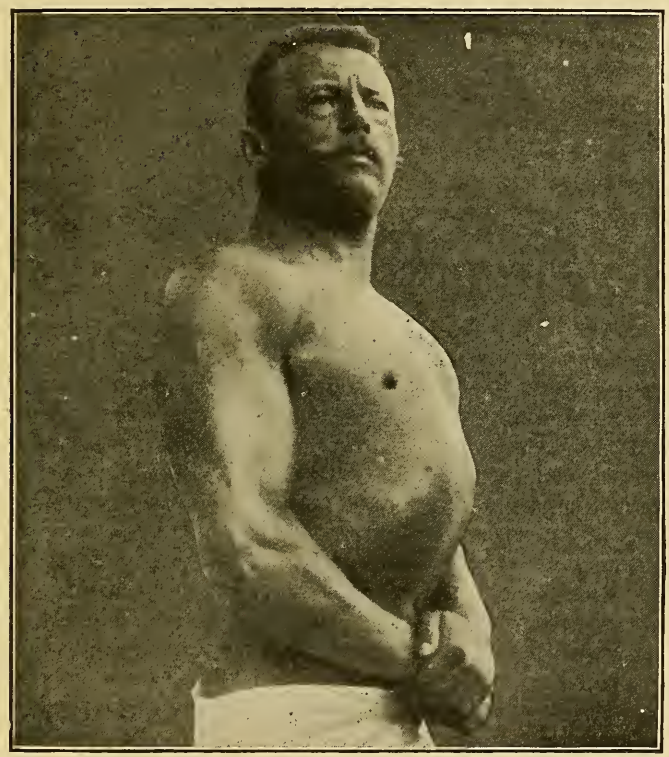


FIG. 2.—A WRONG METHOD OF DEEP-BREATHING.

(Photograph of the Author, taken about 20 years ago, when he did not possess so much knowledge and experience as now.)

from sinking and, therefore, the breath from being a full one; and, secondly, the lack of deep exhalation, of which the effect may be the above-named lung and heart troubles. It is, therefore, not only wrong, but in the long run also dangerous, always to walk about with the chest too highly-arched and the abdomen too much drawn in. The natural easy bearing of the body we always see in the ancient Greek statues is the healthiest and also the most beautiful, at all events in the eyes of those who have a properly developed taste. But I am sure that if a Swedish gymnastic teacher or a military drill sergeant were to visit the museum and contemplate, not from

the front, but in profile, an Apoxyomenos, a Doryphoros, or an Apollo Belvedere, they would declare these superb figures round-backed and flat-chested.

Samples of the third class, the "strong men," are not difficult to find because they are so fond of exhibiting themselves, posing and photographed, in the most unnatural and overstrained attitudes. As mentioned on p. 53, it becomes quite habitual to performers of "feats of strength" after inhalation to arch the chest and brace all the muscles of the trunk, especially the abdominal, while they hold their breath. By degrees they become firm believers in the false theory that this is quite the right method of deep-breathing, and that the highly inflated upper chest and the deeply indrawn abdomen are the very symbols of imposing, superhuman strength. I have selected a few amongst the many hundreds of photographs regularly appearing in the weight-lifting and "strong men" papers (see Figs. 1 and 2), and reproduce them here as warning examples.

Should the Breath ever be held after a Deep Inhalation?

I have seen books on "Deep-Breathing" and "Breathing for Health," in which every single exercise was breath-holding, combined with some movements of the limbs. There may be cases where the holding of the breath for a fairly long time (a minute or more) might be a useful exercise calculated to strengthen the lungs and heart. Setting aside certain occasions of urgency (*e. g.*, when diving and rescuing drowning persons), this should never be combined with feats of exertion, and can only be recommended to quite healthy and well-trained adult persons whose vital organs are already really strong. But, as has already been stated in the preface, this booklet has not been written for this class of individuals, who are probably few in number. Persons suffering from consumption, asthma, and heart diseases might easily kill themselves by this practice. And even overtrained athletes or muscle-bound weight-lifters who imagine themselves to be so strong and healthy, should, above all things, avoid holding the breath, because it is just this habit, combined with over-inflation of the lungs, which is responsible for emphysema or heart disease. Therefore, speaking generally, I do not recommend any breath-holding exercise. But an exception must be made in the case of singers and speakers. If their internal organs are strong and healthy they can undoubtedly increase their particular capacities by such exercises, especially when combined with such good exercises for the abdominal muscles as Nos. 3 and 6 of "My System." It is not, however, necessary to give directions for these cases in this little volume, since the matter has been fully dealt with by so many authors.

The Importance of Physical Exercise immediately before Deep-breathing.

In scores of books in all languages deep breathing is recommended, and always prescribed in the same manner, namely, that in the early morn-

ing one should stand in front of an open window and perform a long series of very full respirations, more often than not combined with holding of the breath—but nothing else.

Ten years ago, in my first book, "My System," I maintained that it was a wrong idea to stand quietly and take deep breaths without any previous physical exertion. And all my considerable experience since that time has convinced me that I was right. It is always a healthy practice in daily life to take fairly deep and regular breaths, but the special full respirations, whereby large quantities of air are pumped into the lungs, should never be performed unless the body really needs this extra supply; otherwise derangement in the relative pressure of the vessels of the body will be caused, the equilibrium in the tissues will be disturbed, and giddiness and dizziness result. On the other hand, the deep breaths will be much more complete, will be performed much more easily, and give much more comfort, if combined with some form of bodily exercise or physical exertion requiring increased change of air in the lungs.

If such exercise only lasts a very short time, we should utilise the opportunity and take some deep breaths immediately after it. And if the exercise is of longer duration, one may very well perform deep breathing continuously during the movements.

Beginners in the art of breathing who have not yet learned any special gymnastic exercise, may profitably practice deep-breathing when walking to or from their business. They should take 4 to 6 strides during inhalation and 5 to 7 during exhalation. After some practice the number of strides may be considerably augmented. But there should always be one or two more strides during exhalation than during inhalation. When the lungs have become still stronger, it is an excellent plan to run a few hundred yards, and then walk and perform a number of deep breathings, which now will naturally be very full. Then repeat the run and the walk, with deep-breathing, several times.

The reason why so many "inventors" of special deep-breathing exercises recommend holding of the breath, sometimes for a rather long period, is, I am sure, that they intend by this means to create a need for more air. They have realised that it is not easy to breathe very fully unless such need exists. But instead of producing this need in a natural way, by good bodily exercise, they have resorted to the highly artificial method of holding the breath. It is undoubtedly true that one is forced to take several full respirations after having held the breath for a minute or more; but if one does not possess a strong heart to start with, the organ will certainly be injured. Proof of this I give elsewhere in this booklet.

The Importance of Slow Exhalation.

A good full inhalation depends on a good deep exhalation, but the opposite relation does not exist. If one has taken a very long and deep exhalation, one is bound to follow this with a full inhalation, otherwise there results a sensation of being smothered. But after a full inhalation one ex-

periences no special impulse to perform an exhalation of a corresponding quality or quantity. Hence the prime importance of exhaling. Many people cultivate an inadequate method of inhaling, a sort of inflation of the lungs, with an exaggerated arching of the chest, which eventually may result in the production of emphysema. Full inhalation often comes quite naturally as the result of predisposing conditions, *e. g.*, after muscular effort; but deep exhalation must be specifically learnt. A good deep exhalation demands a certain amount of time, and should, therefore, always be performed rather slowly. Reference to "My System" will show that I always recommend the practice of slow exhalation during the performance of the muscular and gymnastic exercises, and of the rubbing movements as well, even in cases where I sometimes prescribe a rather brisk inhalation. And I adhere, of course, to the same principle in this booklet. The scientific reason for such slow performance of exhalation is as follows:—

The walls of each of the four hundred millions of vesicles in the lungs are constructed of elastic fibres. But this elasticity will in time be lost if the fibres are expanded too much or too often *without giving them sufficient time to contract again*. This is exactly the case with ordinary indiarubber when it is misused. If the vesicles are always filled with air by full inhalations, and if they are never given sufficient time to contract and again expel the air by deep and slow exhalations, the result will by degrees be a morbid slackness of the fibres. When it is remembered that during deflation each of the several millions of vesicles of the lungs has to contract to about one-third of its capacity when distended, it will be readily understood that a considerable amount of time is requisite for the process. The reader may have met athletic-looking weight-lifters or gymnasts or "strong men" with chests as high, broad and arched as a barrel. Some may have admired or even coveted these barrels. But in most cases such chests are but "whited sepulchres." The ribs have become practically immovable, and the vesicles of the lungs have lost their elasticity. Such a chest will be unable to stand a protracted effort without injuring the heart, and emphysema of the lungs itself will probably cause premature death of the individual. Therefore the ideal should be a movable thorax and elastic vesicles, trained just as much by steady contraction as by expansion.

Why should we Breathe through the Nose?

Nature gave us a mouth with which to eat and to speak, and a nose with which to breathe and to smell. We are told that "the breath of life was breathed into man's nostrils"—then why should he not continue to live by breathing through the same channels? The higher animals always breathe through the nostrils. Such "over-domesticated" or degenerate creatures as the pet dog and the fussy, breathless hen are the only exceptions to the general rule. Considered as animals, many human beings also are degenerate, and use their organs in a perverted way, *e. g.*, the mouth for breathing purposes. If we examine the internal structure of the nose, we shall see at once that it was Nature's intention that inhaled air should pass

through this channel. The entrance to the nostrils is furnished with hairs, and farther inwards, the nasal cavities are entirely lined with mucous membrane. Most of the dust, germs and impure particles which enter during the act of inhalation are retained here, and the air is thus cleansed, whilst if the air is inhaled through the mouth, the micro-organisms may pass into the lungs. Especially in cases where the tonsils have been removed by operation, the direct entrance to the bronchiæ and lungs is quite open. In big towns, where the air is always foul, the mucous membrane of the nose has a very hard task to perform, and must, therefore, secrete a plentiful supply of mucus, which will run or drip away from the nostrils. This process is therefore by no means always a sign of cold, but only proof that the protecting organs are performing their duty thoroughly. In some big centres the air is so bad and the smoke so dense that it is impossible for the mucous membrane to arrest all the dust and germs, some of which will, therefore, pass through the throat and reach the bronchi; but if these organs are healthy, they will react against the invasion and throw off the germs, which are ejected with the phlegm in the act of expectoration. This sort of coughing, also, is not at all due to any ailment or cold, but is actually a proof of the sound condition of the organs. On the other hand, unhealthy persons who are without reactive power will retain and store up, day after day, year after year, all this poisonous matter within their poor systems, which become consequently steadily weakened. It is a good habit to cleanse the mucous membrane and the throat each morning or night with a solution of common salt in warm water. When the throat is gargled with this in the usual manner, much phlegm and black substances from the inhaled town air will be dissolved and brought up. The nose is easily cleansed by means of some of the salt water held in the hollow of the hand, then snuffed up into the nose, and finally expelled through the mouth.

If persons who breathe through the mouth have decayed teeth, they will never get fresh air into their lungs, even when visiting the seaside. The inhaled air will be constantly infected by the putrid secretions of the mouth.

Another advantage of nasal breathing is that we become immediately warned, through the sense of smell, of the presence in a room of poisonous gases, or of air which contains dangerous impurities, whilst those who breathe through the mouth as a rule have the nostrils obstructed and have impaired, or totally lost, their sense of smell. Such persons are, of course in danger of becoming quickly suffocated in the case of an escape of gas, or slowly poisoned if working at dangerous occupations, as in the case of compositors, painters, plumbers, pottery workers, etc., who are particularly liable to lead-poisoning.

Especially in cold weather is it of great importance that the inhaled air should be well warmed before it enters the lungs. This heating cannot take place adequately unless the air is inhaled through the nose. Many chills and inflammations arise solely from the fact that the air inhaled through the mouth is too cold for the bronchi and the mucous membrane of the lungs. Now, the interior of the nose is splendidly arranged as a feed-

heater. There are one small and two big pieces of muscle or cartilage in the inner cavity of the nose, and between these are three irregularly formed passages, the walls of which are entirely covered with mucous membrane filled with warm blood, which thus constitute a very large heating-surface. The air during inhalation is dispersed over this large surface, and the irregularity of the walls of the passages prevents it from rushing through too

Fig. 3.—The Correct Manner of Opening the Nostrils when Inhaling.

quickly. By this means even very cold air is heated to a temperature not much below that of the body. At the same time this inrush of fresh air forms a most effective massage for the mucous membrane. If it be deprived of this massage, as is the case with mouth-breathers, the membrane will degenerate and become the seat of chronic catarrh or of adenoids.

Adenoids are a species of tumour, and are growths of the lymphatic tissues of the upper part of the throat. Their presence may be detected by the fact that the child suffers from chronic nasal catarrh, and breathes through the mouth, which is usually held open. The obstruction and con-

sequences give the child a stupid, sluggish look. Adenoids occur chiefly in children from four to fourteen years, but very young children have been known to suffer from them. Being morbid growths, they are always due to ill conditions of the mucous membrane, and that is why all children should be taught from infancy to breathe through the nose. This may be achieved by the mother taking great care to close her baby's lips whenever

FIG. 4.—THE WRONG MANNER OF INHALING, BY SUCKING IN AIR, AND THEREBY CLOSING THE NOSTRILS.

it is asleep. The infant will soon acquire the habit to its benefit in more ways than one.

The most effective cure for adenoids is that of surgical removal, and is in nearly all cases a very simple and not dangerous operation, often performed merely with the doctor's finger.

Besides which, the duty of the nasal mucous membrane is not only to heat the inhaled air, but also to moisten it, or saturate it with vapour. This process is also unsatisfactorily performed if the air makes a short cut

through the mouth. The mucus of the nose, in the act of secreting the vapour, becomes transformed in dry weather into hard crusts. Therefore the air in rooms heated by radiators, &c., is often very uncomfortable. Flat basins of water should be placed on the top of such stoves, in order to supply the air with sufficient moisture.

There is still another great advantage in breathing through the nose, namely, that one obviates all the risks of making one's throat dry and husky by the continual friction of the air on the back of the throat. Especially in dry weather, or when the air is filled with dust, the mouth breather will suffer from an almost unquenchable thirst. This produces a habit of excessive drinking—a practice which is liable to injure not alone the pocket, but also the health.

The reasons, then, for nasal breathing are many and weighty, and this method ought, therefore, to be adopted as much as possible. In a later chapter, "Hints for Athletes," I mention some cases where it is, unfortunately, necessary to breathe through the mouth. But it is then the more important for these athletes to adopt the normal nasal method both by day and night, whenever they are not occupied in their special sport. Moreover, there is also an æsthetic reason why we should breathe through the nose. Running about with an open mouth always imparts an idiotic appearance. In Denmark we say of such an individual, that "he resembles a cod-fish in rainy weather."

Many persons at first find it difficult to obtain sufficient air through the nose. Very often the reason is that they close the "wings" of the nostrils instead of distending them. They don't know that, in order to get air into the lungs, it is sufficient simply to expand the thorax, which, by creating a vacuum inside, will force the air to rush in. They imagine that the air must be sucked in. But by this suction the wings of the nose will be drawn inwards and pressed against the middle wall of the outer nose, and the nostrils be thus closed. The wings of the nose consist of muscles, which should be trained so that they are able to move outwards and thereby give freer passage to the air. Many persons nowadays have lost their ability to move these muscles. But after a few weeks' practice it is in most cases possible to regain this power. Fig. 3 shows a well-opened nose, whilst Fig. 4 shows how the nostrils are closed when the air is sucked in. For persons who find it very difficult to acquire this control of the nostrils, I can recommend the use of the Albar apparatus. The cheapest model, of silver, costs *7s.*, and will in certain cases prove very valuable to the user.

Why is it generally Wrong to Exhale through the Mouth after Nasal Inhalation?

In a letter I received some time ago from an officer of the Royal Navy, I was asked why in "My System" I recommended both inhaling and exhaling through the nose. The writer thought I was wrong, and he stated further, that "the Swedish system as taught in the Navy tells those who

practise it to inhale through the nose and exhale through the mouth." I have often been asked the same question by German readers, probably because so many German books on gymnastics recommend this wrong method. Lieutenant Hébert, the author of the new French "System," has also fallen into this error (see p. 127 of "L'éducation physique"), and into many other errors as well. Let me now, therefore, answer the question fully, for once and all. Perhaps the most practical way to convince a man who follows this method that he is wrong would be to let him practise it during a hard ski-ing trip up and down the mountains, or when speed-skating a fair distance in a temperature of that sort in which the breath freezes and settles as rime on the beard and eyebrows, and upon the front of the jacket. He would certainly soon feel as if that ornament of the face we call the nose were completely missing, as it would be frozen white both inside and outside; and if he did not quickly rub it with snow he would soon lose it in reality. The reason for this is, that the man, having steadily inhaled ice-cold air, would, at the same time, have lost all opportunity of again heating the frozen mucous membrane by the aid of warm exhaled air, since he had allowed it to escape through his mouth.

When the mucous membrane of the nose has become too cold, it is no longer able to heat the supply of cold air which is inhaled in the ensuing breath. Cold air will then enter down into the lungs and produce colds and perhaps pneumonia.

A similar danger may be incurred even during the summer, if the air is very dry. Not alone the mucous membrane of the nose, but also that of the lungs, will then become too dry and irritated and no longer capable of resisting the attacking germs. The only means of preventing this is to allow the exhaled air, which is always saturated with vapour, to pass away through the nose instead of through the mouth.

There is still a third reason why exhaling through the mouth is wrong. If there are bacilli or other dangerous organisms in the air—and this is always the case in railway compartments, and even in the open air of big centres—many of these germs will be arrested at various stages by the mucous membrane. But if there is a regular, steady draught downwards, some of these bacilli or germs will, owing to the absence of an expiratory current, certainly travel farther and farther downwards. This will happen if inhalation is always made through the nose and exhalation through the mouth. But if there occur every alternate instant a current of air in the opposite direction, *i. e.*, if exhalation be performed through the nose, a number of the germs will be expelled again. In the absence, also, of this outward passage of air, paroxysmal attacks of sneezing, which at times may be very persistent and most distressing to the sufferer, are induced by Nature's efforts to get rid of the obstructing or irritating particles.

Fourthly, I have a reason, arising out of my personal experience, for recommending exhalation through the nose. As readers of my former books will have remarked, I always recommend comparatively slow exhalation. Now, if we exhale through the nose, we are bound to do it slowly.

But if exhalation is performed through the mouth, it is possible to do it very quickly by a sort of "puff." And it is my experience that beginners in the art of breathing nearly always succumb to the temptation of exhaling in this seemingly easy manner, if they are ever allowed to use the mouth for this purpose.

A fifth reason I find in a booklet by Dr. Halls Dally. He calls it a grievous error to breathe in through the nose and out through the mouth: "The pupils subsequently may become confused as to the direction, and breathe in through the mouth and out through the nose. This has happened not infrequently within my own experience."

Shut Your Mouth!

Recently a friend of mine lent me an old book, "Shut your mouth, and Save your life," by George Catlin, London, 1875. It is out of print, but ought to be reprinted. The author studied the life of Indian tribes in North and South America. He found sanitary conditions among these savage races much better than among civilised races, and during his investigations he was more and more convinced that the reason was that the Indians always breathed through their nose, not only in the daytime, but also when sleeping. They were taught to do so as babies, their Indian mothers always closing their children's lips when the latter were asleep.

I should like to make a few quotations from this sane old work:—

"All persons going to sleep should think, not of their business, not of their riches or poverty, their pains or their pleasures, but, of what are of infinitely greater importance to them, their lungs; their best friends, that have kept them alive through the day, and from whose quiet and peaceful repose they are to look for happiness and strength during the toils of the following day. They should first recollect that their natural food is fresh air; and next, that the channels prepared for the supply of that food are the nostrils, which are supplied with the means of purifying the food for the lungs, as the mouth is constructed to select and masticate the food for the stomach. The lungs should be put to rest as a fond mother lulls her infant to sleep; they should be supplied with vital air, and protected in the natural use of it; and for such care, each successive day would repay in increased pleasures and enjoyments. . ."

"It is the suppression of saliva, with dryness of the mouth, and an unnatural current of cold air across the teeth and gums during the hours of sleep, that produces malformation of the teeth, toothache, and tic douloureux, with premature decay, and loss of teeth, so lamentably prevalent in the civilised world. . . ."

"It is, most undoubtedly, the above-named habit which produces confirmed snorers, and also consumption of the lungs and many other diseases, as well as premature decay of the teeth, nightmare, etc., from which it has been shown, the savage races are chiefly exempt; (and I firmly be-

lieve) from the fact that they always sleep with their mouths closed, and their teeth together, as I have before described. . . ."

"Open mouths during the night are sure to produce open mouths during the day; the teeth protrude if the habit be commenced in infancy, so that the mouth can't be shut, the natural expression is lost, the voice is affected, polypus takes possession of the nose, the teeth decay, tainted breath ensues, and the lungs are destroyed. The whole features of the face are changed, the under jaw, unhinged, falls and retires, the cheeks are hollowed, and the cheek-bones and the upper jaw advance, and the brow and the upper eyelids are unnaturally lifted; presenting at once the leading features and expression of IDIOCY."

It is quite true what the author just quoted remarks on the snoring habit being produced by breathing through the open mouth. The reason is that the inspired and expelled draughts of air strike against the uvula and soft palate, setting them in vibration and giving forth anything but a musical sound. While it is better for the habitual nose-breather to have the pillow as low as possible, I should advise that a child, while being trained to breathe only through the nose, should have its pillow arranged at such a height and so placed (under the head, and not under the shoulders) that the head will be kept well raised when the child lies on its back, for if the head is too far back there is a tendency for the jaw to drop open.

Laughter—A Healthy Method of Exhaling.

It would be difficult to name a more healthy exercise than laughing, especially good, hearty laughter which "makes one's sides ache," as people say. It is, therefore, a splendid thing for the health to see a good comedy played, or the antics of a good clown, and it would be much healthier still if these things were not, as is, unfortunately, nearly always the case, indissolubly connected with foul air and late hours.

Laughing is produced by a sort of exhalation in gusts, in the production of which the abdominal wall is alternately braced and relaxed.

The healthy effect is partly direct, by shaking and massaging of the viscera; partly indirect, by creating good spirits, which promotes metabolism.

Let us, therefore, enjoy a good laugh as often as we have the opportunity.

CHAPTER II.

THE MACHINERY OF THE BREATHING APPARATUS.

It is not necessary for me to give here a full explanation of the anatomy of the breathing organs, nor to enter upon a long physiological disquisition on the various issues which present themselves. I will also leave aside entirely the influence of the nervous system, and the chemical changes which occur, because detailed descriptions of all these matters can be easily found in hundreds of text-books of physiology and treatises on breathing. I will content myself with dealing only with the mechanism involved, briefly outlining the functions which occur during the respiratory process, with a view to correcting some common errors which are prevalent concerning the matter.

Fig. 5 shows the human trunk opened in front so that most of the internal organs are visible, and Fig. 6 gives a skeleton-like side-view. The whole inner cavity is divided by a horizontal, but dome-shaped, partition-wall (the diaphragm) into an upper part (the thoracic compartment), containing the lungs and heart, and a lower part (the abdominal compartment), containing the liver, gall-bladder, stomach, kidneys, intestines, etc. Now, it is obvious that the more the thorax is enlarged and expanded in various directions, the more fully can the lungs, by inhalation, be inflated with fresh air, rich in oxygen. And, on the other hand, the more the thorax, during exhalation, can be contracted and narrowed, the greater the amount of foul air, containing carbonic acid, that will be expelled from the lungs.

What Constitutes a Respiration?

One inhalation or inspiration, and one exhalation or expiration, constitutes one breath, or respiration. Inhalation and exhalation will always follow alternately upon each other in a definite space of time, and on the greater or shorter duration of these periods depends what we call the measure or rhythm of respiration. When the individual is in a state of rest, there is no need for any great change of air in the lungs, and it will then be sufficient to take comparatively small or incomplete respirations in slow measure. But as soon as the individual begins to move or work, much more air is needed, and the more the effort is augmented the greater will become the necessity of supplying the lungs abundantly with fresh air, and of getting rid of the vitiated air, since all the chemical processes involved grow intensive to a degree corresponding with the physical effort. The

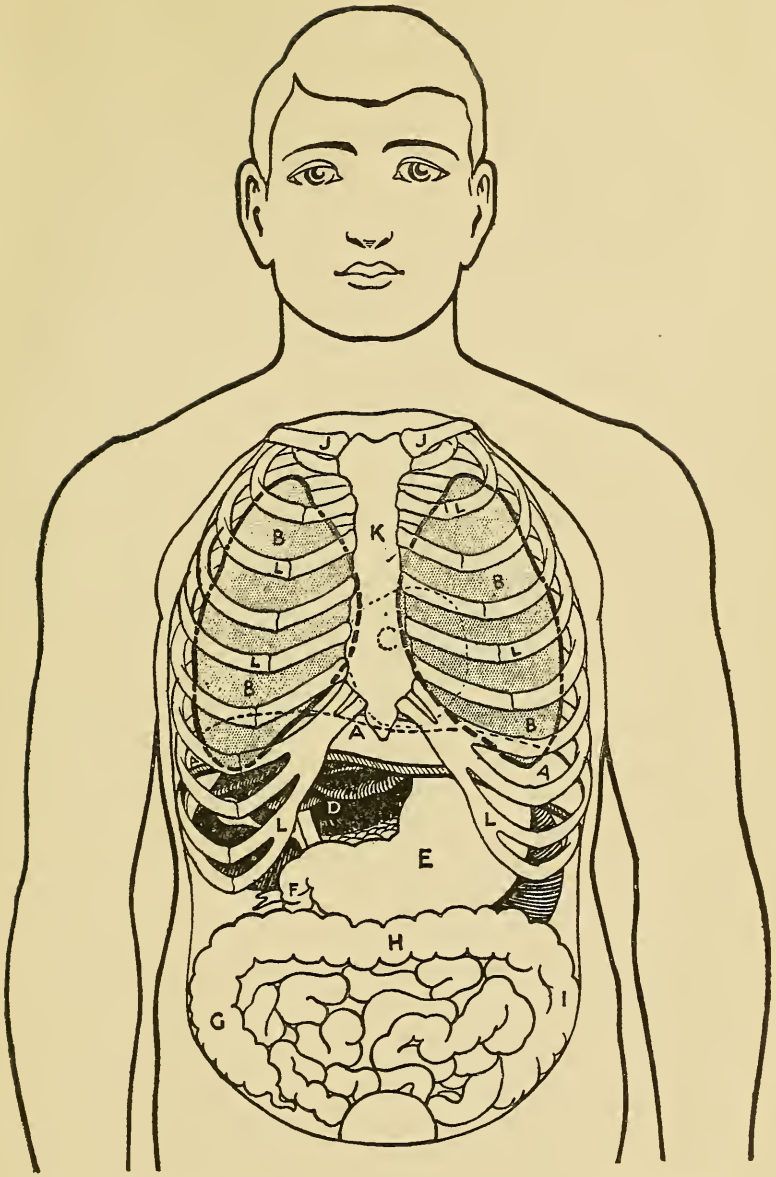


FIG. 5.—FRONT VIEW OF INTERIOR OF THE HUMAN TRUNK.

A—Diaphragm. B—Lungs. C—Heart. D—Liver. E—Stomach. F—Pylorus. G, H, I—Colon. J—Collar Bones. K—Breast Bone. L—Ribs.

individual is thus forced to take as complete breaths as possible, and these in much quicker measure. If, now, the individual is unable to expand and contract the thorax and lungs sufficiently to enable the requisite change of air to take place, he will get "out of breath," succumb to the effort, and, if these conditions are long sustained, the vital organs will be injured. It is, then, very important for every human being, even for persons of sedentary life, to develop and maintain the elasticity of the respiratory organs, because nobody knows when the moment may arrive when great exertion may be demanded of these organs. Unfortunately so many people cannot take what I call a complete breath. Either they do not know how to do it, or they may be physically unable to do it. In the first case it is easily acquired after a little steady and sustained practice, whilst in the latter case it will, of course, take a much longer time to develop the working power of the breathing organs. Still, it is always possible to do this, except in cases of advanced tuberculosis or very old-standing emphysema, or asthma.

How to Expand and Contract the Thorax to its fullest Extent.

The thoracic cavity can be widened during inhalation, and, of course, again narrowed, during exhalation, in three diameters, or in six different directions. There is vertical expansion both upwards and downwards, and horizontal expansion in four directions, namely, to the left and right sides, to the front, and backwards.

Fig. 7 (an orthodiagram by Dr. Halls Dally) shows how the thoracic cavity is increased upwards, the collar bones and the shoulders being lifted. The altered position of the nipples shows that all the ribs and the breastbone have also been raised. At the same time the diaphragm has been considerably depressed, the result being a downward increase of the thoracic cavity. The transverse or lateral expansion to both sides, right and left, is also clearly shown in Fig. 7. In the case of a well-developed athlete, this lateral expansion will be still more considerable. It is greatest in the region of the lower ribs, because these are much more movable than the upper ones.

When the ribs are raised and moved outwards sideways, they, together with the breastbone (sternum), are simultaneously brought somewhat forward. This constitutes the expansion of the thorax to the front (see Fig. 8A). The work of moving the ribs is performed mainly by several small muscles placed upon, between, and inside the ribs (intercostal muscles and serratus major). The large breast muscles, or pectorals, do not share at all in the work of breathing; on the contrary, if overdeveloped, *e. g.*, by exercise on the parallel bars, they will tend to check the elasticity of the thorax. It is, therefore, from the point of view of breathing, foolish to attempt to build up a chest of muscle instead of enlarging the cavity and increasing the size of the lungs.

Finally, we have the horizontal backward expansion, forming the sixth direction in which an enlargement of the thoracic cavity is possible. It is

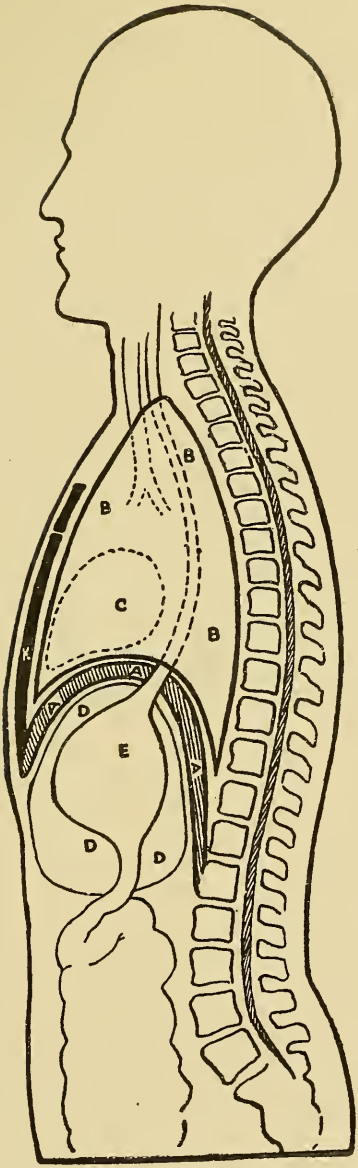


FIG. 6.—SKELETON-LIKE SIDE-VIEW OF TRUNK.

A—Diaphragm. B—Lungs. C—Heart. D—Liver. E—Stomach. K—Breast Bone.

performed by a backward movement of the whole upper and middle part of the spine (see Fig. 8B). It was Dr. J. F. Halls Dally who, first of all, scientifically established this fact. He said, in a recent lecture: "I can find no reference to this movement in eight of the latest and best known

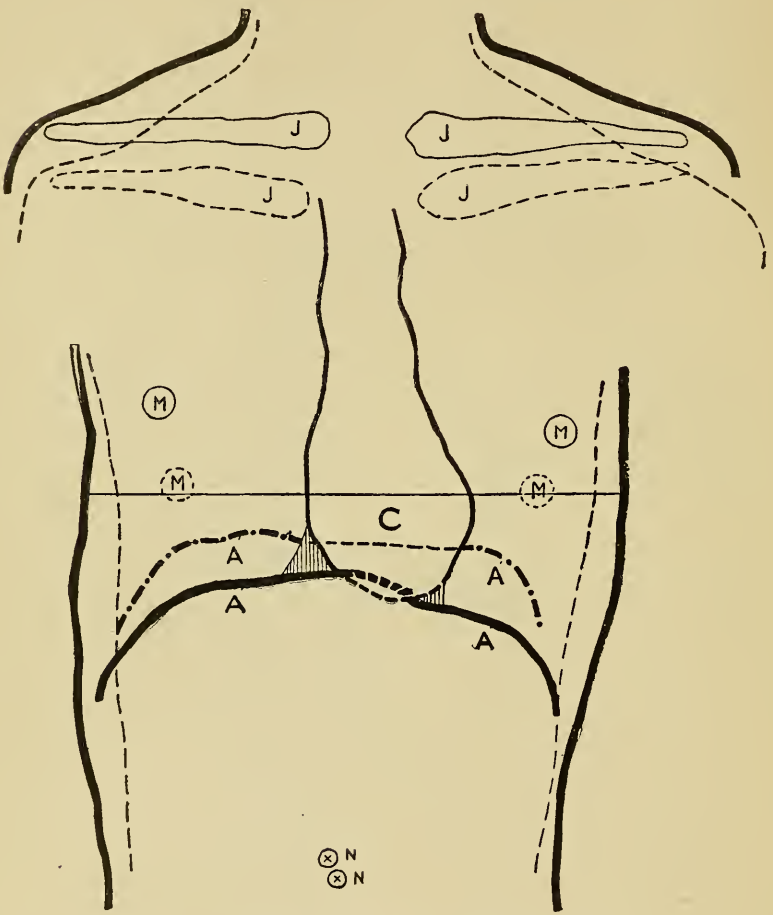


FIG. 7.—ORTHODIAGRAM BY DR. HALLS DALLY.
(Black lines. Inhalation. Dotted lines: Exhalation.)
A—Diaphragm. C—Heart. J—Collar Bones. M—Nipples. N—Navel.

text-books of physiology. That this movement is actual and of mechanical advantage in breathing can be verified by visual and orthodiagraphic examination. . . . Throughout inspiration there is a backward spinal movement which is of importance in securing maximum aëration of the lungs." (This fact, hitherto quite ignored, is fully explained by Dr. Halls

Dally in "An Inquiry into the Physiological Mechanism of Respiration, with especial reference to the Movements of the Vertebral Column and Diaphragm." (*Journ. Anat. and Physiol.*, Vol. xliii., 1908, p. 93; *v.* also *Proc. Roy. Soc.*, Feb. B., Vol. lxxx., 1908.)

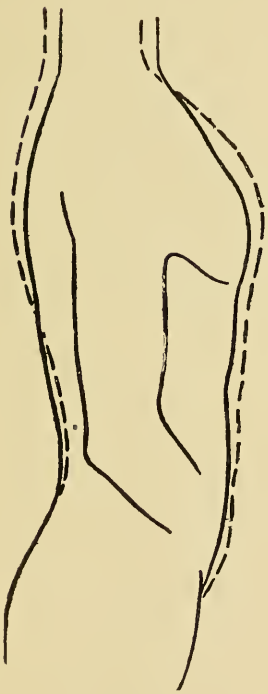


FIG. 8A.

The horizontal expansion to the front and backwards during inhalation (dotted lines).

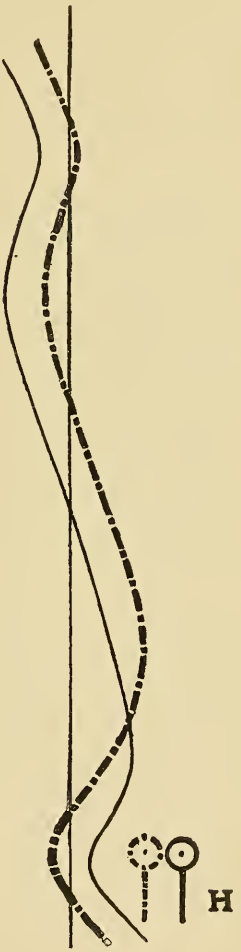


FIG. 8B.

The backward movement of the spine during inhalation (continuous black line), according to Dr. Halls Dally. H—Hip Joint.

The thoracic cavity is again diminished, and exhalation thus performed, when the chest contracts all over, and the diaphragm ascends (see the dotted lines of Figs. 7 and 8B). The lowering of the shoulders and collar-bones is caused simply by their own weight, whilst the downward and in-

ward movement of the ribs, sternum and spine, in ordinary breathing, is caused partly by the weight of the bones and partly by the elasticity of the whole thorax, when the inspiration muscles relax. But when deep breathing is concerned, the ribs should by definite muscular force, be pressed further downwards and inwards. The result will be a triple profit: Firstly, a much larger amount of the vitiated supplemental air will be driven out of the lungs by each exhalation; secondly, the small vesicles of the lungs will get an opportunity of contracting to a fair degree, thereby retaining their elasticity; and, thirdly, the ribs will not grow rigid, but the thorax will retain or still further increase its mobility.

Which of these Six Different Expansions are the most effectual in promoting Free Access of Air to the Lungs?

Opinions upon this point vary greatly. Some authors (as, for instance, the English doctor, H. H. Hulbert) maintain that the horizontal, lateral expansion alone gives the best result, others (like the French Lieutenant, Georges Hébert) assert that this is attained only by the diaphragmatic movements. And, in order to prove their theories, these authors point out that the lower lobes of the lungs are larger than the upper lobes. Again, there are others who try to convince us that the antero-posterioral expansions are of greater value than the lateral. And, finally, there are some who claim just the same for the vertical expansion of the collar-bone region, even going so far as to declare that the thorough practice of this movement would result in the complete prevention of the tuberculosis plague.

The whole argument is not of much value, because the fact remains that absolutely none of the various expansions can be dispensed with if complete respiration is to be performed. On the other hand, it may be of some interest to institute a comparison. I would, therefore, point out that vertical expansion will, in a well-developed male, extend to about 2 inches upwards and another 2 inches downwards, four in all; and horizontal lateral expansion would be about the same, namely, 2 inches to each side, whilst antero-posterioral expansion will very seldom amount to more than 1½ inches in all. The backward movement of the spine will always be small, never more than ½ inch.

Is it ever Reasonable to Perform an Incomplete Breath?

It seems quite obvious that for the healthy working human being, especially for athletes, sportsmen and singers, the only sensible thing would be to employ the whole capacity of their lungs when breathing. Nevertheless, it is a fact, although incomprehensible, that so many authors of booklets on breathing and singing advocate the use of one single part only, or of a few parts, of the respiratory mechanism, simultaneously severely condemning the use of all the rest. Sometimes exclusive abdominal or

diaphragmatic breathing is esteemed the only saving method; sometimes the so-called lateral costal breathing; now the upper costal and now the inferior costal method; now and then even the clavicular or collar-bone form of breathing.

It is only in the case of defects or ailments of the chest that certain special parts of the lungs should be favoured, either with a view to developing such defective parts, or because it would be dangerous to use any part of the lung that may have been injured.

As to abdominal breathing, it is true that this is sufficient when one is sleeping, or when sitting bent over the writing-desk, or when reading in the easy chair, because in such cases the need of air, or rather of change of gases, is only very small. But as soon as one moves, more air is immediately needed, and it will then be of advantage to employ the entire thorax. And if this has grown rigid and immovable, so much the worse for its possessor. A German arm-chair philosopher has found that of 490 cubic centimetres of air inhaled, only 170 are due to the movement of the diaphragm and 320 to the expansion of the chest. I should think it must have been his own defective respiratory faculty which he measured, because I am sure that the above-mentioned proportion in a well-developed athlete or oarsman, who can inhale 6,000 cubic centimetres, would be a still stronger argument for thoracic expansion. It was formerly a common view that the abdominal form of breathing was the natural one for men, the upper chest form for women. But this view is quite erroneous and only caused by bad habit. When the lower ribs and the whole abdomen are laced immovably in a corset, the woman is, of course, compelled to restrict herself to the employment of the upper chest method alone. And it is for the purpose of repairing the harm done by such old habits that special exercise of "abdominal" breathing is most valuable for ladies. And it is because it also constitutes a valuable massage of all the viscera, and further strengthens the abdominal muscles and increases the ability of controlling them, that I have introduced such an exercise as No. 9 into my "Five Minutes System." We speak popularly, when performing this special breathing, of filling the "stomach" or the abdomen with air; but the air will, of course, only fill up the lower lobes of the lungs, as a result of the thoracic cavity having been enlarged downwards by the descent of the contracted diaphragm. What actually in this case causes the protrusion of the abdomen is, of course, the descent of the viscera, which are allowed to sink down and forwards inside the distended abdominal wall. And this lowering of the viscera will facilitate the descent of the diaphragm, thereby making this "abdominal" breath fuller. During the corresponding exhalation, the abdominal wall is drawn inwards as much as possible, and the intestines are again pressed inwards and upwards, whereby the now relaxed diaphragm is assisted in its ascent.

Another example of a reasonable incomplete breath is explained in my hints for boxers (on p. 82). Almost the whole costal part of the breathing is in this case checked, because the breast-bone and the ribs, especially the

lower ones, are fixed by the braced abdominal muscles. Breathing in this case must be carried on mainly by the aid of the vertical movements of the clavicular region and of the diaphragm. Again, gymnasts who climb ropes by the hands only, or perform hanging tricks on the trapeze, the Roman rings, or horizontal bar, are dependent on this special method of respiration, if they breathe at all during the performance. But in most cases they will be found holding their breath, thereby endangering their vital organs. Also when we spend our time in crowded halls in poisonous air, or are forced to stay in badly ventilated rooms, it is wise to use an incomplete breath, thus respiring as superficially and lightly as possible. We then get only the smallest possible amount of poisons into our bodies. As soon as we come outside into the open air, we should, of course, compensate by breathing very fully.

As a matter of fact physical exercise performed in foul air is worse than no exercise at all, because we inhale about sixteen times more air and, of course, poisons in proportion, when exercising than when resting.

The Secret of the Diaphragm.

Science has not yet been able to unveil this secret. Nobody on earth knows exactly what the diaphragm can perform. Most text-books are, so far as this matter is concerned, full of nonsense. Let me remind the reader that the diaphragm consists of a central tendon surrounded by muscle fibres, forming two domes, of which that on the right side of the body is the larger and higher (see Fig. 7 on p. 30). The exterior parts of these muscle fibres are firmly attached all round—at the sides to the inside of the lower ribs, in front to the breastbone, and to the spine behind. As typical examples of prevalent ideas on this subject, I give below some quotations from books by English and German experts, and I will show that these ideas are wrong. I will then refer to the investigations of Dr. Halls Dally, and, finally, explain my own theory.

In "Breathing for Voice Production" (1903), by H. H. Hulbert, B.A. (Oxon.), M.R.C.S., L.R.C.P., etc., on p. 7, appears the following:—

"Writers and teachers, taking note only of the action of the diaphragm in which the tendon descends when the ribs are fixed, usually make the erroneous statement **that the ribs can be elevated and the diaphragm depressed at one and the same time. This is physically impossible.**"

Dr. Hulbert is here quite wrong. It is not only possible to raise the ribs and lower the diaphragm simultaneously, but this does always actually occur when a correct complete inhalation is taken. See, for instance, Fig. 7, on p. 30, where the X-rays clearly show the diaphragm being depressed some inches, whilst the clavicles and the nipples—and thus also the ribs —are raised some inches in the opposite direction.

On p. 14 the author says: "The arched muscular floor of the thorax is formed by the diaphragm, which becomes flattened when it contracts, and so it increases the size of the thorax from above downwards. If the dia-

phragm is unresisted during contraction it depresses the contents of the abdomen and pushes forward its anterior wall; if, on the other hand, it is resisted by the contracted abdominal muscles, the stomach and liver are firmly fixed against the under part of the dome-shaped partition. So that, when it contracts, the diaphragm raises the chest and expands the ribs TRANSVERSELY."

Here there are as many mistakes as there are sentences. Firstly, if the abdominal muscles are contracted or braced, it is impossible to expand the ribs.[1] And, secondly, even if it were possible, how could it be performed by the diaphragm, which is attached to **the inside** of all the lower ribs? If the diaphragm contracts, *i. e.*, shortens its muscle fibres, it will, of course, bring the ribs nearer to each other and thereby narrow the chest. When the ribs are really widened and the chest raised during inhalation, this must certainly be the result of a force stronger than the diaphragm itself.

And further, on p. 15: "How, then, do we gain the greatest expansion of lung, and how can we best control our breathing? The author (Dr. Hulbert) submits that this is accomplished by fixing the diaphragm, THROUGH THE ACTION OF THE ABDOMINAL MUSCLES; for, by this method, the lower ribs are most efficiently raised."

And, on p. 26: "By drawing in the front wall of the abdomen, the organs are fixed in the arch of the diaphragm. This is the FIRST STEP TO BE TAKEN IN LATERAL COSTAL BREATHING."

Here once more Dr. Hulbert is wrong. If we simply draw in the front wall of the abdomen, the descent of the diaphragm is impeded, and we shall not get the lower lobes of the lungs fully inflated; and, if we contract or brace this abdominal wall, it will be quite impossible to raise the lower ribs, and we shall never get a full breath. It is so simple that everybody can try it on himself. On p. 9, Dr. Hulbert gives a quotation from an "authoritative" anatomical work, Quain's "TEXT-BOOK OF ANATOMY." Let me quote a few passages from this work:—

"The action of the diaphragm is more easily understood than that of the intercostal muscles. By its contraction and descent its convexity is diminished, the abdominal viscera are pressed downward, and the thorax expanded vertically. The fibres arising from the ribs, being directed nearly vertically upwards from their origins, must tend to raise those ribs; and Duchenne has shown that the contraction of the diaphragm by itself elevates and expands the ribs to which it is attached, but only so long as the vault of the muscle is supported by the abdominal viscera; for, when they are removed, it no longer has that action. . . . The keynote of the position is in the action of the diaphragm described by Duchenne, who has shown that **the contraction of the diaphragm by itself elevates and expands the ribs to which it is attached so long as the vault of the muscle is supported by the abdominal viscera.**"

[1] On the other hand, this is easy if the abdominal wall is only drawn inwards; but that does not constitute the movement necessary for controlling the voice.

Further, on p. 13, Dr. Hulbert writes: "By this method of breathing—which we will henceforth call the **Lateral Costal** method—the contracted abdominal muscles fix the stomach and liver in the arch of the diaphragm, so that in its contraction it expands and raises the chest during inspiration. . . . It is maintained by the author (Dr. Hulbert) that this is the explanation of the method used by the old Italian School, in which it was taught that the abdominal wall should be **slightly retracted** —that is, that the abdominal muscles should be contracted, and the vault of the diaphragm supported, and that a full inspiration be taken, by which the diaphragm raises and expands the chest."

Let us investigate all these curious assertions a little. It is here said that the fibres of the diaphragm, arising from the ribs, are directed nearly vertically upwards from their origins, and, therefore, they should be able to raise and expand the ribs. Firstly, as to the faculty of raising the ribs, this could be understood if the diaphragm were really stationary. But, as shown in Fig. 7, on p. 30, the diaphragm descends about 2 inches at the same time as the ribs are raised another 2 inches. Seen from the standpoint of the ribs, the diaphragm thus sinks about 4 inches. How, then, is it possible to imagine that it is the diaphragm which has effected the elevation of the ribs? At all events, not unless it was done by the aid of a mechanism of pulleys! But such a mechanism does not exist. Secondly, as to the expanding of the ribs, I have already proved that a diaphragm, which shortens its muscular fibres, will always have a tendency to contract the ribs, never of expanding them, because it is attached to the inside of them. Further, let us see what sort of "support" the abdominal viscera should be able to give the vault or tendon of the diaphragmatic muscle. Can the reader imagine the viscera being harder or stronger than an iron chain or a thick string? Well, it is a fact that some men are so strong that they are able to break a chain, put around the chest, by expanding the ribs. According to the fallacious theory cited above it is the diaphragm which extends the ribs, which implies that the liver and stomach must be as hard as stone; for, as they do not give way, the poor chain has to go! That the conception of the viscera acting as a firm support for the working diaphragm is nonsense is obvious when one remembers that the diaphragm descends each time that the ribs are expanded during inhalation, and thus exerts a downward pressure upon the always soft viscera. (The abdomen then protrudes a little, but when the ribs, during further inhalation, are raised and expanded still more, the skin is, of course, tightened and the abdominal wall somewhat flattened.)

In German books we find precisely similar wrong ideas concerning the diaphragm. For instance, in Dr. Keller-Hoerschelmann's "Mein Atmungssystem," pp. 44 and 45: "Let us first consider Inspiration. By the contraction of the diaphragm the thorax is expanded in such a manner that the ribs are raised, and that outwards, but only so long as the viscera fill the abdomen. If the resistance of the viscera is lacking—then the ribs will contract. . . . The diaphragm needs the support of the viscera

to be able to raise and expand the ribs. But if strong abdominal muscles are present, these will brace themselves without contracting, and will furnish the abdominal cavity, at the sides and to the front, with firm walls which will not give way. When the viscera are thus unable to escape, they must themselves withstand the pressure, and are somewhat compressed, whereby they make a firm support for raising and expanding the ribs." The same description is found verbatim in Dr. Paul Jaerschky's "Koerperpflege," pp. 39–40. What a laboured method of explaining the simple process of inhalation!

Dr. J. F. Halls Dally on the Diaphragm.

For thirteen years Dr. Halls Dally has been engaged in investigating the subject of respiration, both in human beings and animals. He has come nearer the truth than any other living man of science. Amongst other things, he proved that the old theory as to the flattening of the diaphragmatic domes is pure fancy. He found that they move up and down after the fashion of a piston. In his clinical lecture, "Respiration in Health and Disease," he says (p. 12) the following concerning the movement of the diaphragm:—

"For any adequate description of this movement you will consult in vain most of the standard works on physiology. Until the present date most of these works state that during inspiration the central tendon of the diaphragm remains fixed, while the domes flatten in descent, this supposed action being illustrated in many cases by imaginative diagrams. In point of fact no such action takes place. It is true that on orthodiagraphic examination in subjects with well-developed diaphragmatic descent, a slight depression is sometimes seen just external to the summit of the right dome, this being due to the strong downward pull of the right crus; and that in some people with marked raising of the lower ribs the convexity of the dome represents the arc of a slightly larger circle than it does in expiration; but with these minor exceptions, which I only mention for the sake of completeness, it is incorrect to state that any flattening of the domes occurs. As I pointed out in 1903, the curve of the convexity on each side is unaltered in descent, and each half—although attached to its fellow of the opposite side by the central tendon—by means of its own separate innervation through the phrenic nerve, acts quite independently. . . ."

Again, "This second movement (a raising and lateral movement of the lower set of ribs) is also caused by the diaphragm, which, having by this time descended until its central tendon exerts firm continuous pressure upon the intra-abdominal viscera, now executes the second part of its dual action in contracting its ring of costal fibres. These, being attached at an oblique angle to the ribs, in contraction raise the ribs upwards and outwards, being aided by the external intercostals and intercartilaginous portions of the internal intercostals."

As we may see, Dr. Halls Dally has not quite emancipated himself from

the old theory of the diaphragm as a rib-moving power. The explanation is, I think, that the X-ray photographs and orthodiagrams certainly give an exact illustration of facts, but they do not tell us anything about the cause and effect of what we see.

My own Theories about the Diaphragm.

When we breathe very quietly—for instance, when sleeping—the diaphragm "pulsates" on its own account, and that quite unconsciously, in a manner similar to the beating of the heart. In this case the slight contractions and relaxations of the diaphragm form almost the only motive power of our breathing. But when more change of air is needed, part or the whole of the thorax expands and contracts, moved by muscles which,

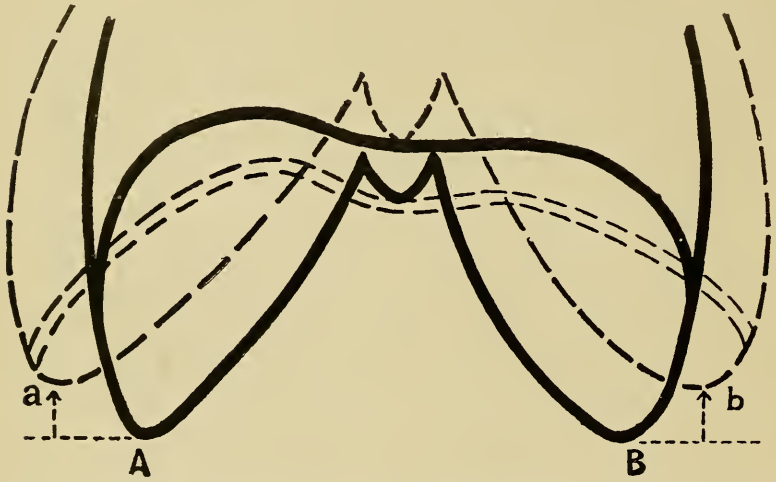


FIG. 9.—SKELETON-LIKE ILLUSTRATION OF THE WAY IN WHICH THE RIBS MOVE THE DIAPHRAGM, ACCORDING TO THE AUTHOR'S THEORY.

in well-developed individuals, are much stronger than the diaphragm. Even if it still continue its own small "pulsations," the diaphragm is now, as a whole, forced to give way to the movements of the lower ribs and sternum, to which it is attached. It will be easily understood that, when the ribs are brought nearer to each other, the whole middle part of the diaphragm will move upwards; and when the ribs are moved away from each other, this central portion of the diaphragm will sink, even though the ribs are at the same time somewhat raised. It is only the outer annular border or margin of the diaphragm which is brought into a nearly vertical position when the ribs are contracted, and into an almost horizontal position when the ribs are expanded and raised, whilst the central part, including the domes, will move up and down without materially altering its shape. The skeleton-like Fig. 9 shows these movements. When the points A and B of

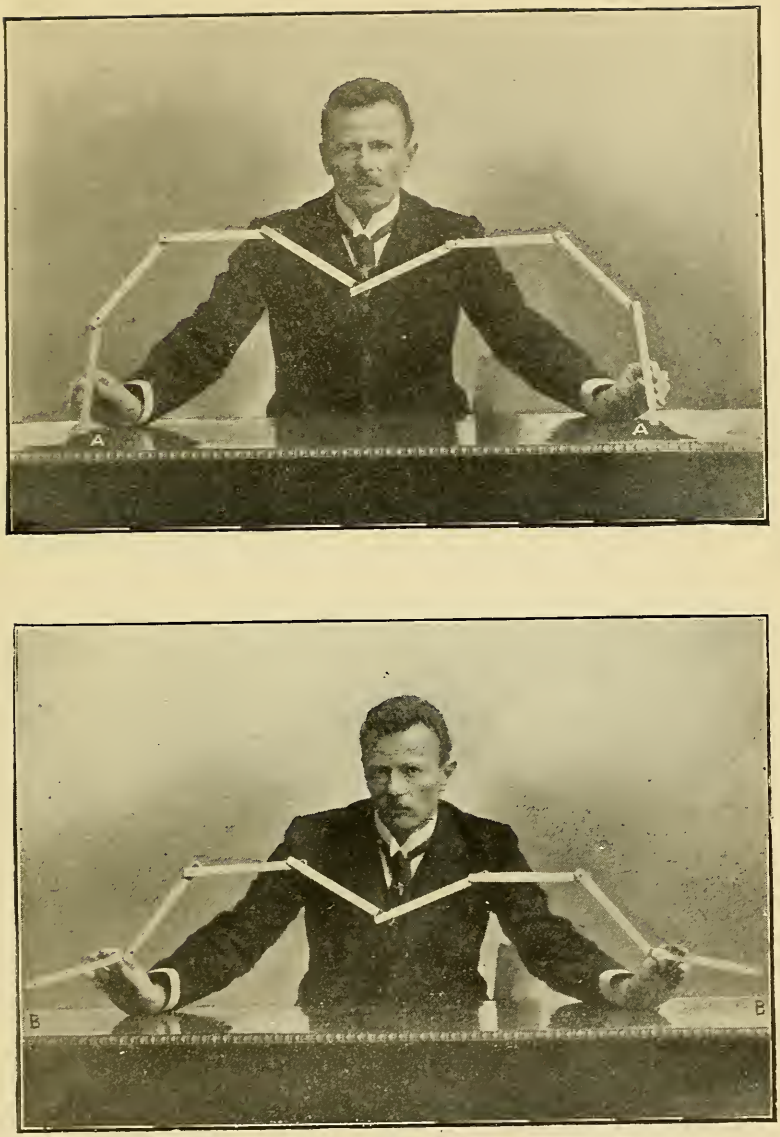


FIG. 10.—A PRACTICAL DEMONSTRATION OF THE AUTHOR'S THEORY AS TO THE MOVEMENTS OF THE DIAPHRAGM.

When A A (representing the lowest points of the ribs) rise to B B, the whole middle part of the carpenter's rule (representing the domes of the diaphragm) must sink.

the ribs move outwards and upwards to *a* and *b* respectively, the domes will sink, but are quite able to keep their shape.

In the photographs of Fig. 10, a quite practical demonstration is given of the relation between the movements of ribs and diaphragm respectively. Any reader possessing a carpenter's rule can try this experiment for himself, and thus become convinced of the soundness of natural laws, whilst all former theories are at variance with these of my theory, which explains these movements in accordance with laws.

The muscles which move the ribs are the various intercostal muscles and the serratus major.

I think there exists a good deal of old superstition about the diaphragm, this mysterious organ, which, nevertheless, every man in the street, in his own fancy, knows just as well as his pocket.

I am convinced that it is quite impossible to move the diaphragm separately, intentionally or voluntarily, although, of course, we move it indirectly by moving the ribs or the abdominal muscles. It would be easier to believe it to be true, as is asserted, that certain Hindus are able to arrest the pulsation of their hearts for a short period, because we can locate the heart both by feeling and by hearing it. And in such cases it is easier to get a connection of nerve between the brain and the organ in question. But the diaphragm cannot be perceived through any of our senses, and I, therefore, maintain it is impossible to establish direct nervous contact with it. I know that many people will assert that such movements as are illustrated in Figs. 44 and 45 are caused by the diaphragm; but it is impossible to explain how the diaphragm can achieve such results. And there is surely no reason why the diaphragm should perform a thing which is easily done by the abdominal muscles. The diaphragm is a quietly and unconsciously working breathing muscle. But it is easy to perform the movements of Figs. 44 and 45 without breathing; or even when breathing in the exactly opposite way, as shown in Figs. 11 and 12, where Fig. 11 represents the fullest possible inhalation, and Fig. 12 the exhalation.

The direct proof of the fact that nobody can move his diaphragm voluntarily, or come into direct nervous contact with it, is that all the sensations which people imagine that they have in the diaphragm are always actually in the abdominal wall, or perhaps in the stomach or intestines. If you ask a person to point out where he thinks his diaphragm is, he will, in nine cases out of ten, put his finger near the navel, or at all events not higher than on a level with the openings of the lower pockets of his waistcoat. But the diaphragm is really situated much higher on the front of the chest, above the point of the breastbone (see Fig. 6 on p. 29), that is, on a level with the upper pockets of the waistcoat.

Further, I have met several elderly military men whose ribs, breastbone and spine had grown quite rigid, thereby rendering the whole thorax absolutely immovable. During many years they had breathed only by using the diaphragm. One would suppose that this would, in consequence,

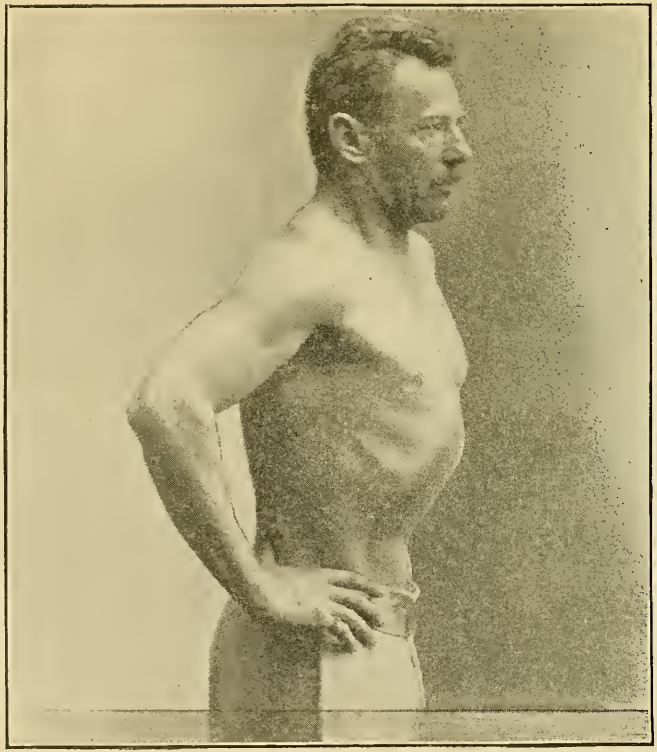


FIG. 11.—A WRONG POSE FOR INHALATION.

FIG. 12.—A WRONG POSE FOR EXHALATION.

Figs. 44 and 45 show the correct poses for abdominal respiration.

have grown very strong, because every muscle which is much used develops. But why, then, was the diaphragm muscle in these cases not able to move the ribs? If, after all, it was at any time possible for the diaphragm to move the ribs, it should surely have occurred in such cases of very strong and practised diaphragms.

I know very well that experiments have been performed in which the diaphragm was paralysed by injection, after which it turned out that the ribs could not be moved so much as before. This was regarded as a proof that it was the diaphragm which moved the ribs. But in my opinion this phenomenon may be explained as follows:—

When the diaphragm is not paralysed it readily follows the movement of the ribs; but, if it be, it will hang on to the ribs as a dead weight, hindering their movements.

It is, after all, not the laity alone who imagine that the diaphragm is a voluntary muscle. For instance, recently I found, in the *British Medical Journal* of August 30th, 1913, the following sentence in the report of the sub-committee for voice training, appointed by the University of London: "Breathing for voice, as contrasted with the breathing of repose, which is automatic and mainly diaphragmatic, presents certain new factors. Of these the employment of the diaphragm as a voluntary muscle is probably the most important.

"When the diaphragm acts in this way, in addition to its descent, which is the more obvious result, the lower ribs are elevated, increasing the transverse diameter of the body at this level, this providing additional space at that part of the abdominal cavity for the viscera displaced by the descent of the diaphragm."

This somewhat vaguely expressed quotation seems still further to suggest that it is the diaphragm which in this case elevates the lower ribs.

CHAPTER III.

THE VARIOUS METHODS OF TAKING A COMPLETE BREATH.

Which is the Best Form of Breathing?

THE best breath is that which, in the easiest and most natural way, with the least strain of muscle or conscious effort, and in the shortest space of time, gives the largest supply of fresh air and the most complete expulsion of vitiated air.

Description of my Ordinary Complete Breath (or, the Relieving Deep-Breathing Exercise).

This has already been explained in the various editions of "My System" for men, for ladies, and for children. All the experience I have had since I wrote my first book, and all my later theoretical studies and practical examinations of thousands of living human beings, have confirmed my conviction that "my complete breath" is the most efficacious and, at the same time, the easiest form of deep-breathing. And being also the quickest manner of completely inflating the lungs, it is the most useful for athletes and sportsmen. I will now describe it still more fully than I did in my earlier works:—

Stand erect, with heels together and the body well balanced upon the whole of your feet. The hands should rest on the hips, the shoulders thus being partly relieved of the weight of the arms. Lean the head very slightly back. Open the nostrils as wide as possible. Stretch the whole upper part of the trunk upwards, simultaneously moving the lower ribs outwards, and that chiefly sideways, but also somewhat forwards, together with the breastbone. The air will then rush in and fill every part of the lungs. This combined lifting and widening of the thorax resembles, to some extent, the movements of an umbrella whose cover is loose on the stick. When we open it a little, the cover will at the same time slip up towards the ferrule, which in this comparison represents our head, the stick representing our neck, the latter being thus apparently shortened. The inflation of the lungs is performed quite automatically, owing to the vacuum which is created in the interior. Hence it is quite wrong to suppose that by sniffing or sucking, more air can be inhaled. On the contrary, this will probably cause a partial closing of the nostrils, since the air, when sniffed in, will have a tendency to drive the wings of the nose into contact with the middle wall. If the inhalation is accompanied with a loud noise, then you may be sure

Fig. 13.—The Correct Pose for Inhalation, Front View.

Fig. 14.—The Correct Pose for Exhalation, Front View.

FIG. 15.—THE CORRECT POSE FOR INHALATION, SIDE VIEW.

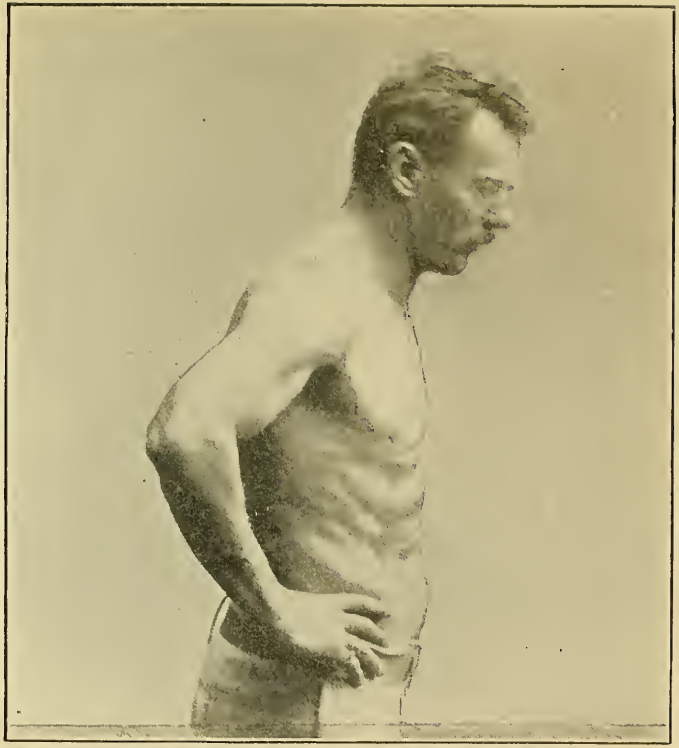


FIG. 16.—THE CORRECT POSE FOR EXHALATION, SIDE VIEW.

that the nostrils are not opened so widely as they ought to be. Fig. 3, on p. 20, shows the nostrils well widened, whilst Fig. 4 shows how the same nostrils are closed by sucking or sniffing. It is a good practice to stand before a mirror and exercise the small muscles which move the "wings" of the nose.

It is a great mistake, during this inhalation, to force the elbows and shoulders backwards and to bring the upper part of the chest into a cramped and highly arched position. It is too hard a strain compared with the result it gives. The upper lobes of the lungs will be filled in an easy and gentle manner simply by the above-mentioned *lifting* of shoulders and clavicles.

It is also a mistake to make a conscious effort to secure the diaphragmatic or abdominal part of this complete breath by distending the abdomen. This will come quite unconsciously, because the diaphragm must sink when the ribs are widened, if only you do not hinder it by forcibly drawing the abdomen inwards. That is a very great mistake: the abdominal wall should be kept in a natural relaxed position. In case of an individual with a very flexible thorax, the widening and lifting of the ribs to any great extent will, of course, straighten and flatten the abdomen somewhat, but there should not be any trace of voluntary movement of the abdominal muscles. So that the only thing to which to pay special attention is the movement of the whole thorax, which is an easy thing for animals and healthy children. But many adult human beings have quite forgotten how to exercise this valuable faculty, elderly gentlemen using only the small abdominal breath, elderly ladies only the short clavicular breath. It can, however, in most cases be easily learned again. By trying it constantly during a few days the person will soon find out which nerves control the intercostal muscles and serratus major. By practice, these muscles will by degrees grow stronger, and, finally, be capable of moving the ribs and thereby the diaphragm to their utmost limit. Fig. 13 gives a front view and Fig. 15 a side view of the correct pose for inhalation. Fig. 17 shows a wrong way of lifting the shoulders without raising simultaneously the whole upper part of the trunk. The complete *exhalation* is performed by the precisely opposite movements. The chin, shoulders and upper thorax are again lowered. The breastbone and the ribs are sunk in consequence of the relaxation of the external intercostal muscles, following upon which the ribs are pressed further inwards by aid of the internal intercostal muscles. The abdominal part of the full exhalation will take place quite unconsciously. It is not a mistake here—as it was during the inhalation—to draw in the abdomen, but it is not at all necessary: the relaxed diaphragm will move upwards, and be instrumental in expelling the foul air, even if the viscera do not press upwards against it. It is, therefore, better to omit this extra work of the abdominal movement here, because my complete breath should be in the nature of a relief.

As to the most important thing, the movement of the ribs, it is, of course, a very easy matter to allow them to sink down. The pressing

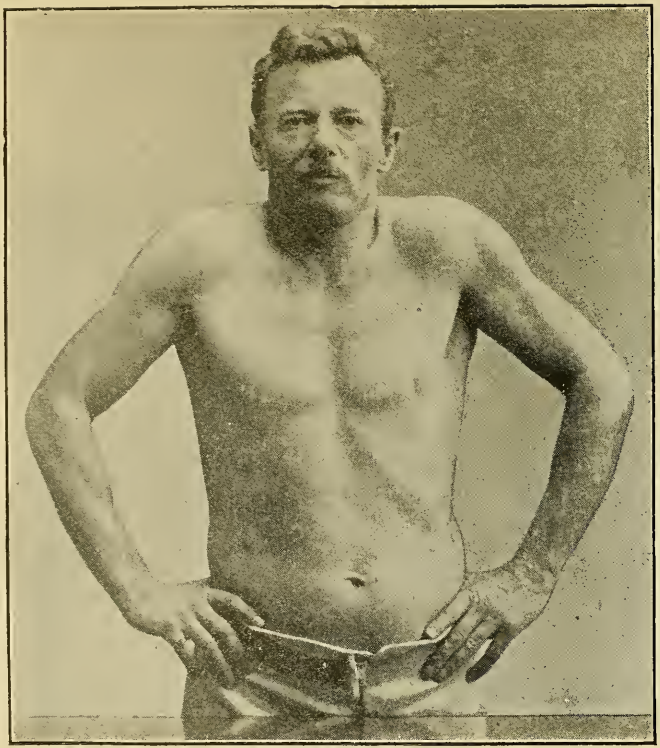


FIG. 17.—A WRONG POSE FOR INHALATION, THE SHOULDERS ONLY BEING LIFTED.

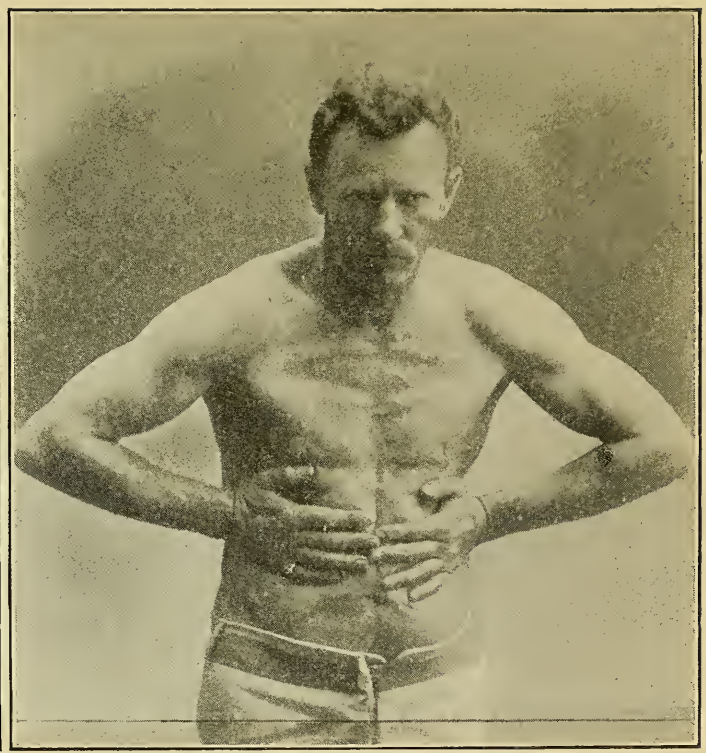


FIG. 18.—SHOWS HOW THE HANDS MAY ASSIST IN THE LAST PART OF THE COMPLETE EXHALATION.

inwards and downwards which follows is more difficult, and will in most cases require some practice before it can be performed correctly. The ribs may have lost their elasticity, in which case they can only with difficulty be moved by the intercostal muscles. It is a good plan for beginners to assist with the hands in the following manner: Take them away from the hips and lay the palms against the lower part of the chest, the thumbs pointing upwards. A pressure, becoming gradually more severe, should then be exerted inwards against the lower ribs, thereby bringing them nearer to each other. Fig. 14 gives a front view and Fig. 16 a side view of the correct pose for exhalation, without any special abdominal movement. Note the great difference between the positions of the lower ribs in Figs. 13 and 14 respectively. Fig. 18 shows the correct position of the palms when assisting in the last part of the complete exhalation.

I have studied scores of booklets, most of them Continental, describing hundreds of various methods of breathing. But I have never seen what I call "my ordinary complete breath" explained before. This is the more remarkable since it is the most natural and easy way of changing the largest possible amount of air in the lungs. And this is just what the practical sportsman, athlete or working man requires to attain by respiration. The reason may be that all the above-mentioned booklets have been written either by indoor students of theoretical science, for whom shallow breathing has always sufficed (as distinguished from the case of the ¼ mile runner when the winning-post has just been passed); or by athletic authors who lack the amount of education and study necessary for describing just what goes on in the interior of the body. Most of such authors advocate only one of the various forms of breathing, simultaneously condemning all the others. One says that abdominal breathing is the best and only natural method, another assures us that this very same abdominal breathing is unhealthy and deforming. Some praise the special clavicular method as the best, because it prevents consumption and improves the bearing of the body; but others call it "the worst form of breathing known to man, an energy-wasting, poor-returns plan, which causes many diseases of the organs and often results in harsh, disagreeable voice." And so on.

The Hindu-Yogi Breathing.

Only twice have I seen advocated a combination of the three main forms of breathing. Let me first mention the "Yogi complete breath," as described in the Hindu-Yogi philosophical books. This is far more complicated and difficult to perform than my complete breath. In the Yogi complete breath the student is instructed first to fill the lower lobes of the lungs, pushing the abdomen forwards, then successively to push out the ribs, first the lower and then the upper ones, afterwards to protrude the upper chest, and, finally, again to draw the lower part of the abdomen inwards. The exhalation is performed firstly by drawing the abdomen still farther inwards and lifting it upwards, the chest being fixed during the ex-

halation and not relaxed until the air is entirely exhaled, when, finally, also the abdomen is relaxed. What an amount of superfluous work for the brain and straining of muscles! And the Yogis call it the only natural method of breathing! Both the inhalation and the exhalation comprise, each of them, two abdominal movements—four in all! And to protrude the upper chest is much harder work than my raising of the shoulders and collar-bones; furthermore, I am convinced that the latter movement is much more effective for the purpose of filling the upper lobes. And why should we fail to avail ourselves of the natural elasticity of the thorax, and the good intercostal muscles, for exhaling? I will not deny that the Yogi books contain several good hints on hygienic matters. But it is rather difficult to find them and pick them out amongst the abundant flow of language wherein they are concealed. The Yogis have, amongst other things, three special modes of respiration, viz., "the Yogi cleansing breath," "the Yogi nerve vitalising breath," and "the Yogi vocal breath," each of them elaborately and profusely described. But I will undertake to prove to anyone who is interested that the "nerve vitalising" and the "vocal" breaths are of just as much (or as little) use for ventilating the lungs as the "cleansing" breath; that the "vocal" and the "cleansing" breaths are just as much (or as little) stimulating to the nerves as the "nerve vitalising" breath; or that the "cleansing" and the "nerve vitalizing" breaths are of just as much (or as little) service in developing the voice as the "vocal breath." In most of the Yogi breaths instruction is given to exhale vigorously through the mouth, sometimes there is even added: "in one great breath through the wide-opened mouth." That this method is wrong, and even in the long run dangerous, I have proved in the foregoing chapters. The greatest part of the Yogi philosophy consists of words, words, words. But very plausible words, I concede.

Dr. Halls Dally's "Full Cycle of Complete Respiration"

is the second combination I have found of the three main forms of breathing. He describes it himself as follows: "Following expiration, there occurs a slight passive protrusion of the anterior abdominal wall. This corresponds to the initial active contraction of the crura and sternal fibres of the diaphragm, which constitutes, as I have just said, the first act in inspiration. Next, following in even and orderly sequence, comes a raising of the lower or diaphragmatic set of ribs, together with backward expansion of the chest over the area corresponding to the lower lobes, the lateral movement being the more marked of the two. . . . The third and last movement consists in full inflation of the part of the chest corresponding to the upper or costal set of ribs, caused by the raising of these by the external intercostals and intercartilaginei, accompanied by an extension of the thoracic curvature, together with a slight backward swing of the thoracic spine as a whole. The whole of these acts, which in complete breathing glide into one another, constitute what I have termed 'the complete cycle

of full inflation.' At the end of this series of movements the chest will be found to be expanded to its fullest extent in all three diameters. Thereupon the chest is deflated, the supplemental air being driven out by powerful contraction of the abdominal muscles. Thus is performed the full cycle of complete respiration."

I am satisfied that this complete breath of Dr. Halls Dally is much better than that of the Yogis. But I still think there is no real reason why we should not use all the lobes of our lungs at once and simultaneously. At all events, we are bound to do so as soon as we put our theoretical deep-breathing into actual practice in athletic exercises, games and sports. For this reason I recommend my own complete breath.

The Great Mistake of Swedish Gymnastics.

As already mentioned, we ought to use also the clavicular or upper-chest breathing to a fair degree, in order to bring the upper lobes into activity, which is important for preventing phthisis or consumption. But it is a very serious mistake to endeavour to carry out all the deep-breathing by this method alone. Nevertheless, you will find this mistake both in the text and the diagrams of most books on Swedish gymnastics, or based on Swedish principles. A good carriage of the chest is a splendid thing, but the Swedish system proves that it is possible to over-estimate the value of this carriage to such a degree that other things of equal importance are almost forgotten. The upper-chest form of breathing is assumed to improve the carriage, and is, therefore, recommended, while the abdominal form is suppressed. And, even in general, respiration is the Cinderella of the Swedish system. Take, for instance, "Haandbog i Gymnastik" (Manual of Gymnastics), compiled by the "Board of Gymnastics," Copenhagen, 1899 (the Board consisting of a professor of the university, two municipal doctors, a military doctor, two officers, and a gymnastic director, from the institute at Stockholm). The book, which professes to be an improvement on the Swedish system, has 476 pages, and all sorts of exercises are abundantly described and illustrated. But the chapter on "breathing exercises" consists only of one very small half-page without a single illustration. In a few lines, a sort of upper-chest inhalation is described, but there is nothing at all mentioned about exhalation; the very word is not to be found in the book!

Considering, firstly, that the breathing is the most important factor of every kind of physical exercise or gymnastics, and, secondly, that deep exhalation is of still more importance than deep inhalation, the above-stated fact is very curious.

I think I was the first author who prescribed exactly, in each single exercise, how and in what part of the movement the pupil should inhale, and how and where to exhale. And I was also the first to introduce the obligatory deep-breathing pause immediately after each single gymnastic exercise. There are sixteen such pauses in my 15 minutes' system, while

in the programme of the Swedish gymnastic "daily lessons," lasting each about forty-five minutes, there is never to be found more than one obligatory breathing exercise, and this is generally placed at the end of the lesson. When I myself, several years ago, was a member of a class being trained by a gymnastic director (diplomaed in Stockholm), this special deep-breathing pause used to occur at the end, when we had finished the lesson by a quick sprint or "running round" in the hall, causing myriads of atoms from the layer of dust on the floor to whirl up and be inhaled in abundance! To-day the state of things is better, of course! Even the Swedish professors have learned a good deal by studying my books, and you may now sometimes meet gymnastic teachers who carefully watch the breathing of their pupils during the various phases of all the exercises performed.

All the illustrations in the above-mentioned manual of improved Swedish gymnastics show the upper chest highly arched, and, at the same time, the abdomen drawn inwards. If this is intended to show that inhalation is going on, then it utterly fails in its object, because the indrawn "stomach" will prevent the diaphragm from sinking, and thus the lower lobes of the lungs from being inflated. And if it illustrates exhalation, it is equally wrong, because the ribs should be contracted during this phase of respiration. The third alternative is to suppose that the illustrations all show the breath being held. But to do this during gymnastics is a serious error, which tends to injure the heart.

Proper respiration being the most essential factor in physical culture, it is no wonder that the death-rate from consumption is so high in Sweden. We must regard the neglect of the organs of the thoracic cavity as the greatest mistake of the Swedish, or Ling's, system, without, at the same time, underrating the other mistakes, viz., the inadequate care of the skin and the neglect of the vital organs of the abdominal cavity. The Swedish system contains no rubbing exercises, no self-massage, no air-bath. It is always performed in long trousers, jersey, socks and shoes, and, therefore, it is incorrectly called "gymnastics," the meaning of this word being "the art of exercising the *naked* body." The exercises which are performed nude in Danish "open air gymnasia" and in German "air-and-sun bathing places" are really far more entitled to the name of "gymnastics." The same is the case with the performances in the new French college of Rheims, founded by the naval officer Hébert who, apparently with good results, has studied the French edition of my "Fresh Air Book."

The internal organs of the abdominal cavity are neglected in the Swedish system in that there are too few effective exercises acting upon these vital parts of the body. There are some simple and slow bendings and twistings of the waist-line, but they are only carried out a few times, which is far too little for keeping these organs in regular working order. The success of "My System" in this respect is, in the first place, due to the fact that the bendings and twistings are performed very strongly and quickly, and without pauses (as soon as the learner's stage is passed); further, that each of these bending and twisting movements is repeated from ten to

twenty times; and, finally, that "My System" contains some very effective combinations of bending and twisting, quite unknown in the Swedish system. I have met several persons, even teachers of Swedish exercises, who suffered from digestive troubles, notwithstanding that they exercised for a whole hour almost every day. They were not healthy until they went in for *my* exercises. And I have scores of letters from Swedish officers and prominent private people, who state that they gave up their national system because it was dull and tedious and not capable of curing their various troubles, but now, after doing "My System," they are fit and well.

Of course, ten or twenty years ago the Swedish system was the very best. But, unfortunately, it was always considered by its patrons and followers as a religious institution, any alteration of which would be blasphemous. Consequently, for 100 years (the Central-Institute in Stockholm was founded in 1813 by Per Henrik Ling) it has never been improved, and now it has naturally become antiquated. The means by which the patrons and professors of this system try to preserve its former renown, and thereby to preserve for their country the lucrative industry of producing and exporting gymnastic teachers for the whole world, are not always quite fair.

During the last nine years the professors of Sweden have abused me personally like a pickpocket, because they realised that my system contained great dangers to their own. It is only in self-defence that, in this chapter, I have taken the opportunity of showing by scientific argument that it is only an old superstition to suppose that the Swedish system is the best of all. The Swedish experts themselves like to call their system the only "*rational, scientific gymnastics.*"

I think I have proved that we have here three lies in three words, just as in the old days one spoke of the "Holy Roman Empire," which was neither holy, Roman, nor Empire.

But outside Sweden itself, during recent years, gymnastics after Swedish ground-principles have been improved very much in other countries, especially in Finland, Norway and Denmark. During a visit to the University of Helsingfors I saw a large body of students performing free exercises with naked bodies (only wearing swimming drawers) and bare feet, although it was midwinter, and the windows of the hall were wide open. Also the "Swedish" drill, taught by the Danish Lieutenant Langkilde and Mr. Junker (Principal of the institute in Silkeborg, Denmark), both of whom are well known in England, is so improved that it would not be very wrong to call it "Danish drill" instead of "Swedish."

How the Heart is often Injured.

It may be useful to discuss this matter a little further. The effects upon the lungs and heart of the various forms of bodily exercise, gymnastics, games and sports are very different. We can, in respect to these effects, distinguish between two large groups, viz., momentary, concentrated feats

of strength (or of quickness), and, on the other hand, prolonged feats of strength performed in a regular measure (endurance). The first group will never be able to strengthen or develop the heart and lungs, and only by careful training will it be possible to avoid positive harm being done to these organs. But the second group may easily serve to develop and strengthen both heart and lungs, and only by very irrational proceeding will it be possible to do harm to the organs. This is the great difference between these two groups. Some of the worst examples of the first group are: lifting of heavy weights, difficult exercises on the Roman rings, trapeze, parallel bar, etc., short and strenuous wrestling bouts; but 100 yard sprints, several passages in football, hockey, and lawn-tennis, and the "crawl" method of short distance swimming, also belong more or less to this group. Good examples of the other are: rowing and sculling, long distance running and walking, skating and ski-ing, the older methods of swimming and all well-measured gymnastic exercises with regular breathing. Some sports, *e. g.*, boxing and cycling, it is difficult to classify positively in the one or the other group. It depends upon the individual manner of working. And several other sports are doubtful—that is, they are scarcely calculated either to develop or hurt the internal organs to a degree worth mentioning. Throwing and putting weights, jumping, golf, and cricket belong, I think, to this category.

The reason why the first-mentioned group is so calculated to injure the organs is as follows: When the lifting of a very heavy weight—or other feat approaching the limit of the individual's power—is to be performed, it is necessary to brace most of the muscles of the trunk, in order that the limbs (for instance, the arms which lift the heavy weight) may have a solid support. But during this stiffening of the trunk almost everybody will hold the breath after having taken a full inhalation. The heart will beat very quickly, because the effort of lifting will be so great. But it will receive less and less oxidised blood, because the lungs will have stopped their work when the breath is retained. The congested red face and the swelling of the neck show how the venous system has been overfilled.

When at last the effort is over, and the air is expelled from the lungs, the blood will rush suddenly into the right ventricles and over-dilate the weak walls. And, if often repeated, this acute dilatation of the heart may become chronic.

This bad form of enlargement of the heart should not be confounded with that sort of enlargement which arises when the muscles of the heart, or the walls themselves, are made thicker, stronger, and more elastic, as is the case when proper feats of endurance and other good games are performed in a sensible manner.

Some doctors, especially on the Continent, where the opportunity of examining healthy athletes was formerly only very limited, would call such a strong and big heart "hypertrophied." But this name ought not to be used to signify that the heart in question is diseased. It is, on the contrary, the strong and big heart of the athlete, which is of the right sort,

even if it is more seldom seen by doctors than the so-called "normal" heart of ordinary weak people.

Well, I must admit that there have also been cases where bad dilatation of the heart has arisen as a result of feats of endurance. But it will then always be found that the individual in question has been wrongly trained, even quite out of condition, or the performance of the feat has been protracted far past the limit of common sense, or possibly both these reasons may apply. How the lungs are injured, and emphysema developed by excessive holding of the breath, I have already explained on pp. 15 and 16.

I may perhaps now be asked if it is, then, my opinion that these "dangerous" concentrated feats of strength should be abolished, since so many people have injured their vital organs thereby. No, not at all. But I would lay down the following conditions: The performer must have thoroughly sound and well-exercised heart and lungs to start with. He must be trained upon a good plan, so that he may become gradually able to perform a greater feat without augmenting the necessary effort. And, finally, he should, if possible, never hold his breath, but by practice acquire the ability to breathe deeply, even when the ribs are fixed and most of the muscles of the body and limbs are braced or working strenuously (see my hints to boxers on p. 82). Then weight-lifting, or other "feats of strength," will no longer be dangerous to him.

I hope my readers will now understand that it is quite wrong to call a weak or diseased heart an "athlete's heart." Even if the heart has been weakened by athletics badly performed, it is wrong to call it an "athlete's heart," because a man ceases to be an athlete the moment his organs are weak. Nevertheless, we often see this error in the daily papers. A paragraph such as the following is typical:—

"A doctor stated at the inquest to-day concerning the sudden death of a naval cadet, N. N., that he had an athlete's heart. After taking part in Swedish drill on H.M.S. X he collapsed. The parents of N. N. live at Y, and he has rowed in races for St. Z's School, where he had good health."

This example also proves that Swedish drill is not capable of curing or strengthening a weak heart, such as often has been the case with "My System." Even if this young naval cadet had formerly weakened his heart by rowing without paying attention to his breathing, it could have been strengthened by sensible free exercises, combined with correct deep-breathing—and his life would then have been spared.

It is a pity that more of our schoolmasters do not take a few lessons in the subject of Respiration, so that they may impart the same to their charges. In England, sensible ventilation of schoolrooms is being looked after to a certain degree, but in some of our old public schools, many of the buildings of which have nothing to commend them but age, there is much room for improvement. But, while the schoolboy in these venerable institutions may be compelled to breathe vitiated air while in the schoolroom, as much compensation as possible should be afforded him by teaching him to breathe properly when in the open air.

I am an enthusiastic supporter of all sports, particularly those connected with running, including football and the like. The cross-country run is a particular favourite of mine, and especially healthful, but only when it is carried out under proper conditions. I know many Public School men who date heart troubles which afflict them from the days when they strove and did not spare themselves for the honour of their school or schoolhouse, in cross-country runs or football matches. With only the "do or die" spirit to help them, they have gone forth, often after a hearty meal, and with not the slightest notion of how to breathe.

In all my experience I have rarely heard or seen any mention of a schoolmaster preparing his boys for a long country run. Luckily for the nation, the average English schoolboy, with his inherent love of sport, is a tough and healthy youngster. But the most robust heart cannot withstand the strain of a long run over rough country if it has to struggle all the while to keep pace with over-rapid pulsations of the lungs.

As I cannot write more here on the subject of running, I must refer my readers to what I have said in the Chapter "Hints for Athletes," page 81.

PART II.

CHAPTER I.

MY FIVE MINUTES' BREATHING SYSTEM.

Specially formulated for Very, Very Busy Men, Overtrained Athletes, Muscle-bound Weight Lifters, Very Delicate People, Consumptives in the First Stage, Singers, Speakers, and School Children.

THERE are people who are, or who imagine themselves to be, so busy that they cannot spare time to do my 15 Minutes' System of Exercises. When people report themselves to be in this condition, I always ask them how they expect to be able later on to get time to lie up sick and ailing. But, notwithstanding my protest, the fact remains that there are such people. And I will not presume to deny a fact, as a country member of the Danish Parliament once said he would. I think it kinder to accommodate the needs of such people by preparing for them a good little five minutes' system.

Then there are other people who have strong muscles, enabling them to play hard games, indulge in strenuous sports or heavy weight-lifting. But they have never learned how to breathe correctly, and, therefore, they are very liable to injure their hearts and lungs just because some of their muscles, being proportionately over-developed, tend to strain the vital organs. On the other hand, if only they would learn the best method of breathing, they would be able to do much more and much better in their special game or sport.

Further, there are people who are so weak that the exercises of "My System," even in their easiest degree, would be rather too much strain if carried out at once. The most important thing for such people is certainly to get their lungs and hearts to work in the good and regular way which it is the object of this little Five Minutes' System to secure. They would then by degrees become prepared to take up the whole of "My System," because their circulation would be improved and their vital organs strengthened. And, furthermore, they would then find it much easier to perform "My System" than would pupils taking it up for the first time, because the exercises in this booklet are arranged with this special purpose in view.

Consumptives in the first stage especially would benefit by adopting this little system. And, what is still more important, if everyone, from childhood, were to perform this five minutes' work daily, consumption

would be entirely prevented. Statistics tell us that this dreadful disease is still responsible for more deaths than any other malady.

Nearly one-half of all deaths in the United Kingdom, between the ages of twenty-five and thirty-five, are due to consumption. It is, first and foremost, complete breathing, with special attention to the upper lobes of the lungs, which forms the most efficacious preventive. Such an exercise is repeated eighteen times in the course of the five minutes. As every doctor can tell you, it is in these upper lobes that the tuberculosis bacilli first settle and start their dangerous work. But if they are disturbed each day and blown away by a stream of fresh air, they can never triumph. And by degrees, when the individual has grown stronger, his own well-trained leukocytes will become able to dispose of every hostile germ. There is, here in England, much valuable active work done in combating consumption. But the most important means has not yet received due attention, namely, the teaching of the younger generations how to breathe correctly. This breathing system, therefore, is eminently suitable for all schools. It would only involve the spending of five minutes between two lessons. And one of the chief effects of such a little arrangement would be the checking of the "tuberculosis" plague.

And last, but not least, there are all the singers and the speakers for whom it is of the utmost importance to develop the capacity of their lungs and the strength and controlling powers of their abdominal muscles.

Why is it not Good always to Maintain the same Position during Deep-Breathing?

Because it would be tiring for the body and tedious for the mind. And, furthermore, there is the risk that not every part of the lungs will be called into play and employed to its own benefit, because the various lobes of the lungs act differently according to the varied positions of the trunk. Full respirations ought, therefore, to be performed with the body in different positions.

At what Time of Day should we Perform this Little System?

In the morning before breakfast, immediately before the daily dip or shower, or as soon as one is partly dressed after the bath. Or in the evening just before going to bed. Or when dressing before dinner. Or at any other convenient time of the day, but not until at least one hour has elapsed since the finish of the preceding meal, and never when one is very hungry.

Hints to Beginners.

The unpractised beginner will always, during the first few days, feel somewhat sore round the waist and between the ribs, sometimes also in the shoulders and between them, and in the thighs and calves. If the beginner does not feel any soreness whatever, it is only a proof that he has

not performed the exercises correctly. If weak people experience a sensation of giddiness, or palpitation of the heart, during the first performances, it is a certain proof that they are greatly in need of such exercises. If the practice be continued daily these symptoms will disappear after one or two weeks. The reason of the giddiness, accompanied by palpitation, is the following: the venous blood is sucked strongly from the head into the heart by the deep inhalations, and the heart is not yet sufficiently trained in the work of simultaneously supplying enough arterial blood in return.

The following nine exercises consist of full respirations performed in various positions of the body, and combined with movements of the trunk in every possible direction, and with several movements of the limbs as well. The arrangement of the exercises is easy to remember, because the first eight exercises form two series, each of which consists of three trunk movements and one deep knee-bending. And the three trunk movements are, in each series, firstly, a backward and forward movement, then a sideways movement, and, finally, a twisting. In the second series the trunk movements, and the knee-bending as well, are all somewhat more difficult than the corresponding movements of the first series.

Each of the exercises should be commenced by a full exhalation, and immediately after each exercise there should follow a short pause of rest, during which two easy and relieving full respirations, *i. e.*, two of "my complete breaths," are performed.

EXERCISE No. 1.

Full breathing during backward and forward bending of body combined with bending and straightening of both arms simultaneously.

Plant your feet firmly about 18 inches apart, with the toes turned slightly out in a natural position. Expel by a deep exhalation as much used-up air as possible from the lungs. Then immediately start slowly bending the upper part of the body and also the head, well over backwards. Whilst you are bending backwards in this manner, you should at the same time take a good, steady inhalation, and also bend the arms and clench the fists. Then you will finish in the position shown in Fig. 19. The shoulders, elbows and hands should be forced well back, the wrists being bent. Now, without stopping in this position, you should start a deep exhalation, performed during a steady forward movement, bending the body as low down as possible, until you reach the position in Fig. 20. The arms are, during the forward bending of the body, gradually straightened, the hands opened and the fingers stretched. Then raise the trunk and arms again during inhalation, and once more bring them back into the position shown in Fig. 19. Bend, for the second time, forwards during exhalation, and so on, performing in all four of these double movements, combined with four respirations, which should be as slow and full as you can make them. Then, of course, the movements are also slow, but they should be carried as far as your flexibility admits. You should curve your back in order to reach further down, but you should keep your legs as straight as possible. By degrees you will become so pliable that you will be able to touch the floor without bending the knees.

(This exercise forms a fair preliminary movement to the Rubbing Exercise No. 11 of "My System.")

The Special Relieving Deep-Breathing Exercise, consisting of two full respirations without accompanying movements.

Stand with heels together, hands on the hips, and take two of my ordinary complete breaths through the nose, as long and as steady as possible.

Rules for Inhalation, Figs. 13 and 14 (pages 44 and 45):

(1) Open the nostrils.

(2) Raise the shoulders, together with the whole upper chest, and lean the head slightly back.

(3) Move the lower ribs as far as possible outwards.

(4) Do not arch the upper chest into a cramped position.

(5) Do not draw in the abdomen, nor brace its muscles.

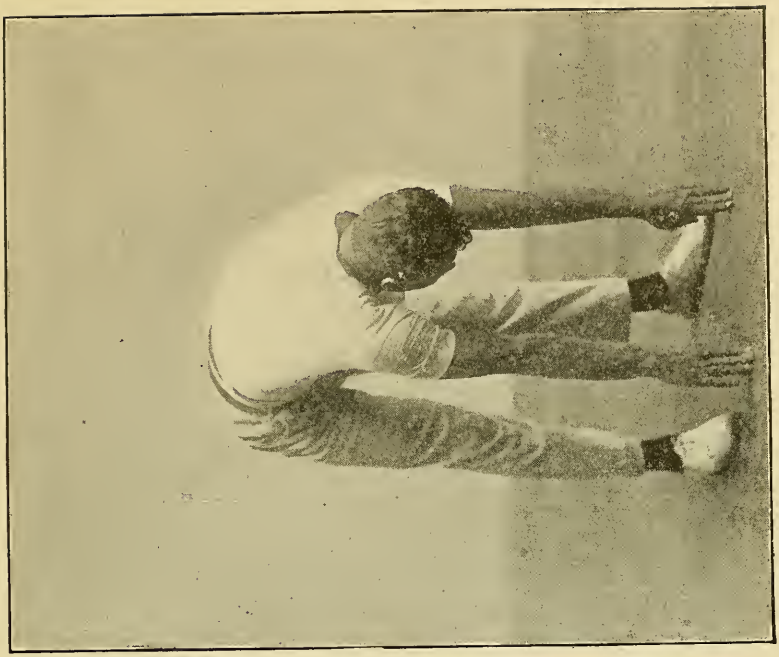


FIG. 20.

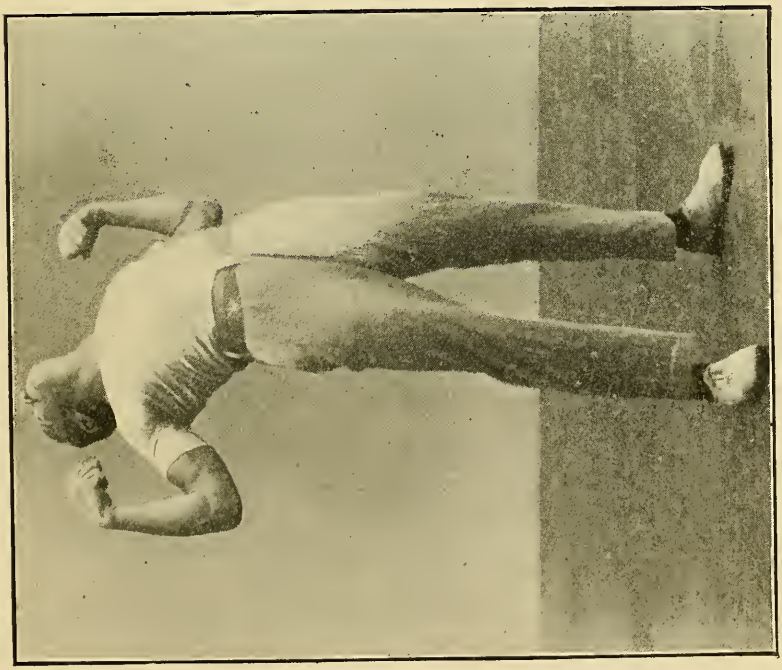


FIG. 19.

Rules for Exhalation, Figs. 16 and 17 (pages 44 and 45):

(1) Let the whole upper chest and the shoulders sink, and lower the chin again.

(2) Let the ribs sink, and draw them inwards and together as much as possible.

(3) Do not draw in the abdomen, but keep it naturally relaxed.

Lady beginners and very weak male pupils are recommended to lie down flat during this deep-breathing pause, and to perform as many of these respirations as they find comfortable. It is better to lie on a sofa, a bed, or in a long easy chair, than upon the floor, because the repeated rising from this would be tiring. The hands should now not be kept on the hips, but the arms should rest on the sides of the body. When the complete breaths are taken in this position, the greatest attention should be paid to the expanding and contracting of the lower ribs.

Ladies should be careful to remove all tight clothes and bands (corset, necklace, etc.).

EXERCISE No. 2.

One-sided full breathing during side-bending of trunk, combined with alternative lifting over head and stretching downwards of arms.

Stand with heels together. Perform the same preliminary exhalation as in Exercise No. 1. Then, whilst inhaling, steadily bend the trunk slowly sideways to the right as much as possible. The right arm to point downwards, but the left should be raised to a half-bent position, the palm being kept as far as possible over the right side of the head (see Fig. 21). This manner of inhalation will provide an extra expansion of the left lung. Then swing the trunk slowly as far as possible over to the left side, at the same time exhaling steadily and deeply. Now the left arm should be stretched downwards and the right curved over the head (see Fig. 22). This manner of exhalation provides an extra contraction of the left lung. Then back again to the position in Fig. 21, inhaling meanwhile, and, for the second time, bend over the left side while exhaling (see Fig. 22). But here you must remember to keep up the position of Fig. 22 whilst you are again inhaling, and do not start the swinging back to the right side until you again start exhaling, after which you should twice repeat this pumping movement in a corresponding manner to the first two double movements, whereby you will be able to provide two extra expansions and contractions of the *right* lung also.

(This exercise forms a fair preliminary movement to the Rubbing Exercise No. 16 of "My System.")

Repeat here the **Special Relieving Deep-Breathing Exercise** (two complete breaths).

FIG. 22.

FIG. 21.

EXERCISE No. 3.

Full breathing during twisting of trunk to alternate sides, combined with arm-raising and lowering to the sides.

Place yourself with the hands clenched and the feet 20 to 25 (according to your height) inches apart. The toes should point straight to the front, as shown in Fig. 23. Perform the preliminary exhalation, then twist the upper part of the body slowly a quarter round to the left, at the same time raising the arms to a horizontal position, and taking a full inhalation (see Fig. 24). Immediately afterwards turn slowly back again to the position shown in Fig. 23, at the same time lowering the arms and performing a deep exhalation.

Then make a corresponding twisting to the right, once more raising the arms and inhaling deeply (see Fig. 25); then back again to the position of Fig. 23, while exhaling steadily and lowering the arms.

Repeat the movement four times to alternate sides, thereby performing four full respirations. It is wrong to twist the legs or move the feet. These should remain firmly planted on the floor during this and the other twisting exercise (No. 7)—the turns or twistings being done only from the waist, the hips being fixed, and keeping so far as possible their position to the front.

(This exercise is the same as the first degree of Exercise No. 4 of "My System.")

Repeat here the **Special Relieving Deep-Breathing Exercise.**

FIG. 23.

FIG. 24.

FIG. 25.

EXERCISE No. 4.

Full breathing during arm-raising to the front and lowering, combined with quick deep knee-bendings, feet apart and without heel-raising.

Stand as shown in Fig. 26, with arms stretched downwards, palms to the rear, and feet as much apart as in Exercise No. 1.

Perform the preliminary exhalation.

Raise the outstretched arms, palms downward, slowly to a horizontal position in front of you, taking, at the same time, a full inhalation (see Fig. 27). Then, whilst starting a deep exhalation, sink quickly to a squatting position without raising the heels from the floor (see Fig. 28). Without any pause while in this position, rise again quickly, at the same time completing the exhalation and lowering the arms. (It is in order to preserve the balance that the arms must be held outstretched to the front during the squatting, and they should only be lowered again during the raising of the body. If you drop them too early, you will be liable to fall backwards, at all events if your feet are in the right position, *i. e.*, with the whole sole planted on the floor.) As the breath is exhaled during the whole downward and upward movement, with bending and subsequent straightening of the knees, this must be carried out in a comparatively short space of time, while the raising of the arms during the full inhalation alone must be performed very slowly each time. Repeat the whole movement four times.

(This exercise is the same as the preliminary movement of the Rubbing Exercise No. 10 of "My System.")

Repeat here the **Special Relieving Deep-Breathing Exercise.**

EXERCISE No. 4.

FIG. 26.

FIG. 27.

FIG. 28.

EXERCISE No. 5.

Full breathing during backward and forward leaning of the trunk combined with tapping successively on upper chest and loins.

Whilst Exercise No. 1 was a backward and forward bending of the body to the limits of its flexibility, this *leaning* backwards and forwards of the trunk is a shorter movement, performed with a straight or hollowed back, and without moving the head independently of the body. Position of the feet as in Exercises Nos. 1 and 4.

Perform the preliminary exhalation. Lean slowly backwards, at the same time inhaling fully and tapping quickly the whole upper part of the chest with the clenched fists (see Fig. 29).

This tapping will cause the inhaled air to penetrate into certain vesicles of the lungs where perhaps it would not otherwise reach. Now lean slowly forwards without bending or curving the back, at the same time exhaling deeply and tapping strongly the whole lower part of the back and loins (see Fig. 30). This tapping will tone up the kidneys and prevent lumbago. Then once more lean backwards and forwards, tapping the chest whilst inhaling and the back whilst exhaling, and so on, performing in all four double movements and four complete respirations.

(This exercise forms a fair preliminary movement to the Rubbing Exercise No. 18 of "My System.")

Repeat here the **Special Relieving Deep-Breathing Exercise.**

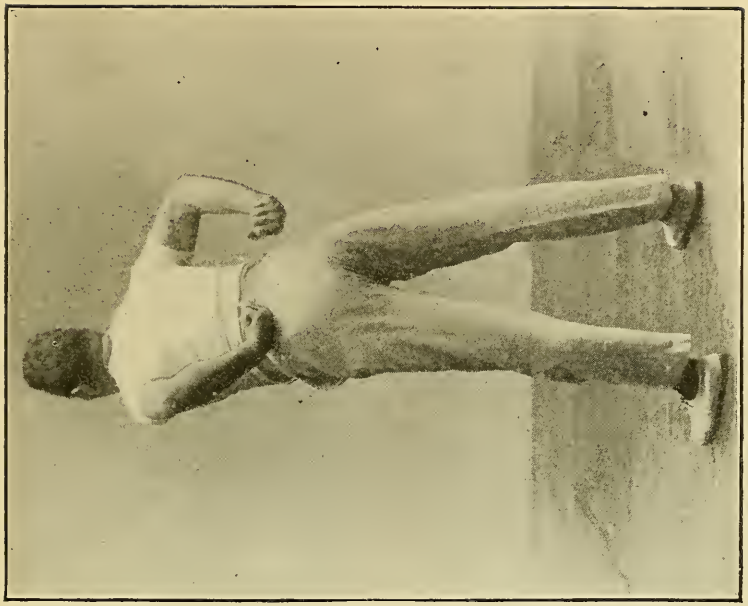


FIG. 30.

FIG. 29.

EXERCISE No. 6.

Alternate one-sided deep exhalation during side-bending of trunk, combined with half knee-bendings.

Stand with hands on hips and the feet somewhat more apart than in Exercises Nos. 1, 4 and 5, the toes turned slightly out in a natural manner (see Fig. 31). Now, whilst performing a deep exhalation, lean the trunk slowly, always facing the front, sideways over the right leg, which must be kept quite rigid, whereas the left knee should be bent as shown in Fig. 32.

Then raise the body and resume the vertical position, shown in Fig. 31, with both legs straightened, at the same time taking a full and strong, but proportionately brisk, inhalation. Stay in the upright posture for a moment, commencing exhalation. Then lean the trunk slowly sideways over the left and straightened leg, bending the right knee, while finishing the long and deep exhalation (see Fig. 33). Then raise the body while once more inhaling, the right leg, at the same time, having been straightened. Pause in the upright posture while commencing exhalation, and, for the second time, lean over the right leg while completing exhalation, and continue in this way these swaying movements four times in all. The exhalations during the alternate squeezing of the lungs by means of the sharp side-bendings will provide an extra means of expelling the foul air from the lungs.

It is a mistake to bend the trunk obliquely forward instead of leaning sharply over to the sides. Remember, also, to lean the trunk over the stretched leg, never over the bent leg. But the weight of the body should be thrown upon the *bent* leg, alternately the right and the left.

(This exercise is the same as the preliminary movement of the Rubbing Exercise No. 12 of "My System.")

Repeat here the **Special Relieving Deep-Breathing Exercise.**

FIG. 31.

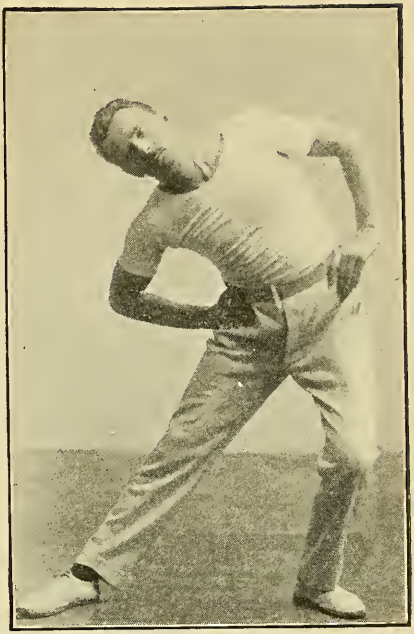


FIG. 32.

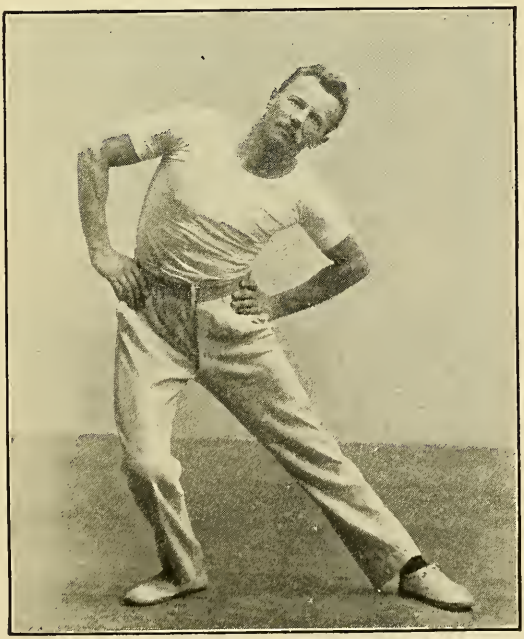


FIG. 33.

EXERCISE No. 7.

Full breathing during twisting and leaning to alternate sides and subsequent raising of the trunk, combined with arm-raising and lowering sideways.

Position as in Fig. 34, which is just the same as Fig. 23 of Exercise No. 3.

This exercise itself is also started precisely in the same manner as No. 3: first perform the preliminary exhalation, then, while inhaling fully, assume the position of Fig. 35 (or 24). But now, instead of turning back again to the front, you should slowly lean the trunk, facing to the left, over the left leg, at the same time lowering the arms and exhaling deeply (see Fig. 36). The leaning of the trunk should be performed with a straight or hollowed back. It is a mistake to curve or bend the back far downwards.

Then lift the arms again, and raise the trunk to the position shown in Fig. 35, and twist it, without any pause, the whole way round to the position shown in Fig. 37 (or 25), meanwhile taking a full inhalation. Now lean the trunk, facing to the right, slowly over the right leg, simultaneously lowering the arms and exhaling deeply (see Fig. 38). Then, while commencing inhalation, again raise the trunk, simultaneously lifting the arms (Fig. 37), and, without any pause, twist round to the left (Fig. 35) while completing inhalation. Now, for the second time, lean the body, fronting to the left, slowly over the left leg while exhaling and lowering the arms (Fig. 36). And so on, performing in all four double movements and four full respirations.

(This exercise is the same as the first degree of Exercise No. 7 of "My System.")

Repeat here the **Special Relieving Deep-Breathing Exercise.**

FIG. 34.

FIG. 35.

FIG. 36.

FIG. 37.

FIG. 38.

EXERCISE No. 8.

Full breathing during arm-raising sideways and subsequent lowering, combined with slow deep knee-bendings, feet together, and with heel-raising.

Stand at "attention," as shown in Fig. 39.

Perform the preliminary exhalation.

Rise on the toes and raise the arms sideways to a horizontal position, at the same time taking a full inhalation. The head should be leaned slightly backwards, the fingers well stretched out, and the arms and shoulders forced as far back as possible (see Fig. 40), which will improve the carriage of the whole body.

Then follows a deep exhalation, during which you should lower your body to a squatting position, but still keep the heels raised from the floor. The arms and the chin are, at the same time, again lowered, and the hands should now be strongly clenched, thus figuratively suggesting that now all the air is to be expelled from the lungs (see Fig. 41). This forms, at the same time, a good exercise for strengthening the fingers.

Now comes the second full inhalation, during which the body and arms are slowly raised until the position of Fig. 40 is again assumed. And, finally, during another deep exhalation, return slowly into the position of Fig. 39, the chin, arms and heels being lowered simultaneously. Then repeat, but, of course, without the preliminary exhalation, the whole combined movement described above.

You will thus have performed, in all, two deep knee-bendings and four full respirations.

(This exercise is the same as the third degree of the special deep-breathing exercise of "My System" with arms outstretched.)

Repeat here the **Special Relieving Deep-Breathing Exercise.**

FIG. 39.

FIG. 40.

FIG. 41.

EXERCISE No. 9.

Special abdominal breathing, combined with movement of the viscera.

Stand with the feet as much apart as in Exercises Nos. 1, 4 and 5.

Place the palms upon the abdomen.

Perform the preliminary exhalation.

Then lean slightly backwards and draw a full inhalation, endeavouring to distend the abdomen as much as possible (see Fig. 42).

Then, while exhaling deeply, bend slightly forwards, press the hands inwards, and move them upwards, as if you wished to push all the intestines up under the ribs (see Fig. 43). Recommence the movement by raising the body and inhaling, at the same time relaxing the hold of the hands, and dropping them a little to the position in Fig. 42. Now, for the second time, press the abdomen and bend forward as before while exhaling, and then once more inhale, raising the body and distending the abdomen, and so on, performing in all four double movements, and four abdominal respirations. When the abdominal muscles, after frequent practice, have grown sufficiently strong, these movements may be performed without assistance of the hands, the drawing in and the distending of the abdomen being performed solely by the force of the abdominal muscles, as shown in Figs. 44 and 45.

(This exercise is almost the same as Exercise No. 17 in "My System for Ladies.")

Finally, repeat once more the **Special Relieving Deep-Breathing Exercise.**

Prevention is Better than Cure.

In reprinting in the following chapter a doctor's record of all the various diseases which may be cured by deep-breathing exercises, I wish, in advance, expressly to emphasise the fact that it is much better, easier, safer, more pleasant, and far less expensive to *prevent* all these diseases. This applies especially to the great tuberculosis plague, the ravages of which would be checked if mothers or nurses would close the lips of sleeping babies, and if children were taught proper breathing by competent teachers who know how to breathe themselves, and if parents and guardians would be on the look out for adenoids (when the presence of these is suspected, the children should be sent for examination, and, if necessary, for surgical operation). The consumption germs would then disappear, not having a suitable soil on which to settle.

EXERCISE No. 9.

FIG. 43.

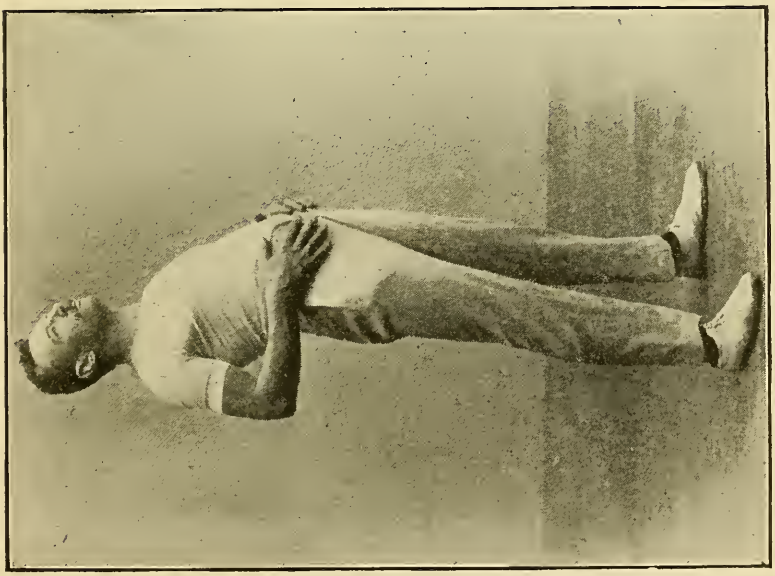


FIG. 42.

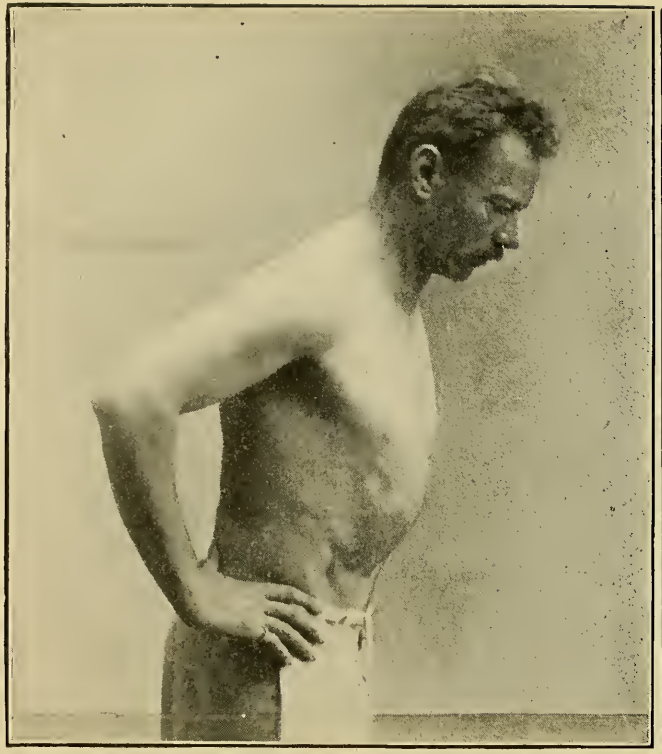


FIG. 45.—CORRECT POSE FOR ABDOMINAL EXHALATION.

FIG. 44.—CORRECT POSE FOR ABDOMINAL INHALATION.

Figs. 11 and 12 show Incorrect Poses.

CHAPTER II.

WHICH AILMENTS CAN BE CURED BY DEEP-BREATHING EXERCISES?

One of the first doctors who took up "My System" (15 Minutes' Exercises) for the benefit of himself and his patients was Dr. Keller-Hoerschelmann, Chief Physician of Erlenbach Sanatorium, near Zürich. He prepared a special set of breathing exercises, which he applied in hundreds of cases in combination with my rubbing exercises. In his book, "Mein Atmungssystem," he gives a record of various diseases which were cured by these means—a list of which I herewith append:—

(1) *Diseases of the Nose and Nasal Cavity:* Chronic catarrh of the nose, nose bleeding and small polypi. Long-established and large adenoids must, of course, be removed by operation.

(2) *Diseases of the Gullet, Throat, Larynx and Bronchi:* Chronic catarrh of the throat, the Eustachian tube and the bronchi; swelling of the tonsils; inflammation of the vocal cords; hoarseness; stammering and struma. The original cause of stammering is not so much nervousness as simply a wrong method of breathing through the mouth. Stammering may be defined as an involuntary, nervous hesitation and vibration of the under jaw when suddenly called up from its habitual hanging position to perform its part in articulation.—A bronchocele as big and as hard as a fist was removed in nine months by correct breathing.

(3) *Diseases of the Lungs:* Weak lungs; incipient consumption, nervous asthma, malformation or adhesions following pleurisy; emphysema, and chronic catarrh of the lungs. In the second and third stages of consumption there is the risk that the tuberculosis bacilli may spread over healthy parts of the lungs, or that hæmorrhage may arise. But in the early stage of the disease the beneficial effects of breathing exercises upon the lungs and the whole body will always be considerably greater than the risk. Regular exercise of the lungs and the consequent greater interchange of air will prevent the germs from thriving, and the augmented supply of leukocytes will destroy the bacilli.—Dr. K.-H. cured over half a dozen severe cases of asthma. He found that, in such cases very slow exhalation was the most important point. The case is the same with emphysema, because the cure here depends on the possibility of restoring the elasticity of the vesicles of the lungs and the mobility of the ribs. He also recommends pressure with the hands during exhalation (see Fig. 18, p. 47).

(4) *Deficient Development of the Thorax:* Hollow chest, pigeon-chest, rhachitic thorax, and curvature of the spine.

(5) *Heart Diseases:* Weakness of the heart, fatty degeneration, dilatation, atrophy, nervous palpitation, asthma, arhythmia, and minor organic diseases of the heart. If the heart be too small—anæmic—inhalation is the chief curative factor, but in most other cases exhalation plays the greatest *rôle.* In cases of nervous palpitation, exacerbation may occur during early lessons, but improvement will be noticed after the third or fourth lesson.

(6) *Diseases of the Liver and Kidneys:* Blockage of the liver, enlargement of the liver, deficient production of gall, gallstones, bilious complaints, renal calculi, and blockage of the portal vein. Abdominal breathing is the most important factor for augmenting the secretion of gall, and for the removal of various obstructions and checking the formation of stones.

(7) *Diseases of Metabolism:* Anæmia, chlorosis, obesity, excessive thinness, gout, diabetes, rheumatism, nervous disorders, neuralgia of the head, and scrofula. Millions are paid yearly for pills and tinctures of iron to relieve anæmia and chlorosis, with the sole result that the stomach and teeth are ruined. By deep-breathing exercises the metabolism is stimulated and the production of good blood quickly augmented.

(8) *Deficient Circulation of the Blood:* Headaches, dizziness, faintness, lethargy, cold hands, cold feet, swelling of the veins, varicose veins, and piles.

(9) *Diseases of the Stomach and Intestines:* Apathy of the stomach, dilated stomach, protruding abdomen, chronic stomachic catarrh, cardialgia, indigestion, constipation, chronic catarrh of the intestines, and adhesions after peritonitis.

(10) *Diseases of the Nervous System:* Neurasthenia, hysteria, with various complications, such as pains in the limbs, mental exhaustion, melancholy, hypochondria, irritability and other mental disorders.

(11) *Diseases of Women:* Abdominal weakness, chronic complaints of the uterus and appendages, sagging of the broad and narrow ligaments, and menstrual irregularities.

(12) *Sea-sickness* and *Fainting Attacks.*

I would warn readers, on the other hand, not to perform any Deep-Breathing Exercises when suffering from any of the subjoined ailments:

(1) All acute illnesses with fever.

(2) Acute bronchitis; pneumonia, pleurisy, and peritonitis.

(3) Cerebral bleedings, atheroma, thrombosis, embolism, phlebitis.

(4) Advanced tuberculosis.

PART III.

HINTS FOR ATHLETES.

For Sprinters.

During the run itself there should be a minimum of respiration, but before and immediately after a maximum should be indulged in. Many sprinters hold their breath whilst they are down on all fours, waiting for the shot or word of command from the starter. This is a great mistake. Breaths as complete as possible should be taken. When "Are you ready?" has sounded, a very full inhalation should be taken, and on "Go" a steady, slow expiration started, which should last for as much of the 100 yards as possible. If you can run the last bit without breathing at all, so much the better. If not, you should take only short gasps through the mouth, because full inhalations will check the pace of a sprinter.

Sprinting is a great strain upon the heart and lungs. Therefore, as soon as the winning post is passed, one should carefully take as complete respirations as possible, hands on hips and body erect, just as described in the chapter on "My Complete Breath." During the first few seconds you will perhaps be obliged to keep the mouth open, but as soon as you can restrict yourself to nasal breathing, the better. Sprinting is not a good exercise for the respiratory organs and the heart. This sport ought, therefore, only to be indulged in by persons with thoroughly sound organs, and every sprinter ought to strengthen his lungs and heart, and keep them fit, by daily nasal deep-breathing exercises, combined with body movements.

For Middle-Distance Runners.

Both in the longer sprinting distances (120—350 yards) and in the middle distances there is so great a need for air that most athletes are here obliged to keep the mouth wide open. But it should be regarded as a makeshift, and ought never to become a habit when running slowly, or on ordinary occasions. When leaving the starting mark the runner should immediately begin to pump as much air as possible into the lungs, even more than he feels he immediately needs. If he omits this precaution, there will soon come an instant where he will find himself very short of air. The middle distances are a still greater strain on the heart and lungs than the 100 yards. My remarks above, on the necessity of having sound organs, and of strengthening these by other effective exercises, are, therefore, still more appropriate here.

For Long-Distance Runners and Quick-Walkers.

These groups of athletes ought to develop a regular, deep nasal respiration not alone in daily life, but also when they are indulging their particular sport. Their running or walking sport itself will then become a splendid exercise for the lungs and the heart, as distinguished from the short and middle distances. A certain number of strides should be taken during inspiration (say four) and the same number during expiration. Here it is a question of racing or of keeping almost the same speed as in racing, where a quick change of air in the lungs is needed, and must not be confused with the special exercise of deep-breathing performed during ordinary walking, which is explained on p. 17.

An athlete who trains himself to be capable of breathing regularly in long distances will not only thereby strengthen his respiratory organs, but he will greatly increase his stamina and staying power. There is still another reason why long-distance athletes ought to use nasal breathing exclusively. The damage which may ensue from inhaling germs through mouth-breathing during the few seconds or minutes of short and middle distances may never be considerable. But hours spent in this way, especially in the dust of the high road, is certain to be most harmful. Long-distance athletes who can only with difficulty get enough air through the nose will find the Albar apparatus (mentioned on p. 22) very useful.

For Speed-Skaters.

There are two things which tend to make speed-skating a healthy pastime. Firstly, it is as a rule performed on the ice, in nice, fresh air free from dust. Secondly, the rhythm of the movements simply leads to the performance of a regular deep respiration, inhaling when resting upon the one skate, when exhaling upon the other. And I have found it most convenient to inhale whilst the right leg slides, and exhale upon the left. The reason for this is that the right leg will always be the outward leg in the curves; and, if these are made in correct style, the upper part of the body will rise a little every time the right skate is *trailed* upon the ice into its position in front of the left foot, whereas the body will sink further downwards when the weight in turn is thrown upon the left leg.

The lower the temperature is, the more necessary it will be to keep exclusively to nose breathing. The Albar apparatus will not always be useful, because it is often necessary to warm the nose, and to get rid of the "water" which pours out more freely during a severe frost.

For Boxers and Wrestlers.

A boxer who adopts correct breathing methods will not only greatly improve his stamina, but will also by this means strengthen the more vulnerable parts of the body, which will make him less liable to be knocked out.

A boxer should respire regularly and deeply through the nose during the whole round. If he holds his breath when making specially severe efforts, he will soon get out of breath. And if he respires through the open mouth, he runs the risk of biting his tongue, and, what is much worse, the blows he gets on the jaw will hurt him severely. But when the teeth are clenched and the muscles of the jaw contracted, he can withstand much more punishment. Of course, it is not necessary to keep these muscles braced the whole time. But when the mouth is shut, the jaw can be set as quick as lightning, and quite instinctively, whenever a blow threatens.

It is important that the boxer keep breathing regularly and deeply while ducking, bending, crouching, side-stepping, and during all other quick movements of the body. The slow rhythm of the breath must be quite independent of whatever else he is doing. The severest degrees of Exercises Nos. 2, 5, 16, 17, and 18 of "My System" form splendid training for this purpose, especially the three last, the quick trunk movements, when performed at a rate of at least three or four double movements during one complete respiration.

As long as the body is out of reach, the boxer should respire as nearly as possible according to the scheme of my complete breath, taking full advantage of the costal breathing. But as soon as it comes to close quarters, the boxer must brace the whole abdominal wall in order to protect his stomach, and, above all, the solar plexus. If the upper part of the straight abdominal muscles are in a state of softness and the ribs relaxed, a blow in this region will go through and do damage. But if these muscles are thick, strong and hardened, and the ribs fixed, a severe blow can be taken here without much harm. Almost every athlete understands how to brace these muscles and fix the lower ribs. But nine out of ten will, at the same time, hold the breath. Now, it is obvious that, if a boxer holds his breath for several seconds and repeats this performance frequently during a round, he will very soon be out of breath. And if he, gasping for air, relaxes the abdominal wall, then he will easily be knocked out, or, at all events, be hurt severely if he is hit on the mark. He must, therefore, learn how to keep a regular breath going, even when the abdominal muscles are braced and the lower ribs thereby completely fixed. It is somewhat difficult to breathe under these conditions, because it is quite impracticable to move the lower ribs. The only possible form of respiration in this case is, then, a combination of clavicular and diaphragmatic breathing, which must be practised until it can be performed unconsciously. I have never seen this fact mentioned or explained anywhere, but I suppose there are, or have been, champions who quite instinctively did this. I do not think I can better illustrate the importance of this method than by giving an account of my first meeting with Bombardier Wells. It was a short time after his defeat by Carpentier that the English champion called upon me, accompanied by a mutual friend. They were somewhat depressed, and they wanted me to try to find out what really was amiss with the Bombardier. They told me that one expert had said that he suffered from a sort of nervous indigestion,

that somebody else had told them about a mysterious disease in the region of the solar plexus, with more of that sort of thing.

I asked him to strip. I have seen and studied thousands of men naked —for thirty years it has been one of my hobbies. The numerous sea-bathing places of Scandinavia and the crowded air-baths of the Continent, where people do not wear any clothing, have given me rich opportunities. At the first glance I saw what nonsense had been written about the Bombardier's famous waist-line. How often have I not read that this part of his body was too long, or that it was too weak for a boxer. But now I was able to ascertain for myself that his waist and trunk are unusually short. It is his very long thighs which make him so tall. As to the imaginary weakness of the Bombardier's waist-line, I can assure my readers that only once in my life have I seen a man with stronger or more beautiful muscles round the waist.

I examined him, let him breathe fully, etc. I saw he could brace his abdominal muscles until they were as hard as steel, but I also saw that he was holding his breath while doing so. Here was the Bombardier's weak point, then; he admitted that he was soon out of breath if he braced these muscles while in-fighting, and he also admitted that they had been quite relaxed when he received Carpentier's body blows. I then explained to him the method of regular breathing with braced waist-muscles, and the best way of learning and practising it. I told him how to perform certain movements of "My System" in an extra severe degree, above all, Exercise No. 6, with very slow leg-circling, and with heavy boots or weights on the feet. This exercise especially strengthens the muscles guarding the solar plexus, and, when combined with the prescribed deep breathing, it produces the ability of respiring during fixation of the lower ribs and contraction of the above-mentioned muscles.

It is interesting that it is just this leg-circling exercise of mine that has contributed so much to the restoration of the British Champion's superiority. When the Swedish translation of "My System" appeared some eight years ago, it was severely criticised, and I was called a charlatan and an ignoramus by the representatives of the Swedish gymnastics. Above all, the principal of the Central Institute in Stockholm, Professor L. Törngreen, wrote long condemnatory articles in certain papers. It was my Exercise No. 6, especially, which he declared ought to be entirely rejected, because it was a physical impossibility to breathe during its performance! Which affords a good example of how conceited certain public authorities are, and how stupid, even when dealing with their own special subjects.

I also showed Wells another good exercise for practising this method of breathing with ribs fixed and the abdominal wall braced. Lying upon my back on the floor, I let him stand upon my "stomach" for a rather long time whilst I continued the regular respiration. And I further explained to him how it was possible to sit in a chair, or in a railway compartment, and practise this combined clavicular and diaphragmatic breathing during

voluntary contraction. It should be done for two or three minutes at a time by the watch. Finally, I recommended him, after some practice, to let his sparring partners use his stomach as a punching-ball. I think he had regained a good deal of self-confidence by the time he left me.

Several of these hints will also be useful for wrestlers, more for Græco-Roman than for Catch-as-catch-can exponents; but most of all for Cumberland and Westmoreland wrestlers, who are forced to stay at close quarters for long periods, often with several muscles of the body contracted.

For Swimmers.

Most other sports and games can be performed, even records be beaten, without special attention being paid to correct breathing. The harm done to the heart may only be detected some long time after the "records" have been declared and published. But in swimming it is quite another matter. It is quite impossible for a swimmer to do anything until he has learnt a convenient method of breathing. It is really a part of the game itself, which necessarily must be studied as early as the movements of the limbs. It follows that every expert swimmer knows how to breathe when in the water, and my hints on this special subject will thus be only of use to beginners. In all styles air is inhaled quickly through the mouth, and exhaled slowly through the nose under the surface of the water. Mouth breathing is, perhaps, not so harmful as on shore, because of the absence of dust; but, in a London swimming bath, it must be borne in mind that the air is apt to be foul, which makes it the more necessary that when not in the water swimmers should acquire the habit of the more hygienic nasal breathing.

Beginners often feel out of breath, although they think they have kept the mouth wide open. They should endeavour to open the mouth as wide as they comfortably can, or even a little more, in order to get sufficient air. It is also a common error to raise the head, or to bend it sideways, in order to keep the mouth clear of the water. It should only be turned, the neck being twisted. If a swimmer doing the breast-stroke bends his head backwards to inhale, or when doing the side or overarm-stroke, he lies on his right side and bends his head to the left, thereby raising it above the surface, his legs will immediately sink and the pace suffer. In the crawl it is, of course, still more important not to raise the head, because the very principle of this stroke is to keep the feet above the water, acting against the surface.

Swimming under water should only be performed by strong and well-trained individuals, because it is an enormous strain upon the heart and lungs. Just before plunging, the lungs should be filled by a full breath after my method, and the air is only gradually exhaled in small quantities at a time while swimming.

For Oarsmen and Scullers.

Some readers will deem it strange that I draw a comparison between two such apparently dissimilar sports as rowing and speed-skating. But in some points both of them are specially healthy forms of exercise, because they are ordinarily performed in fresh, open air, and because it comes quite naturally to breathe regularly and deeply during the performance. The reason for this is that the time of the movements in rowing and in speed-skating is not only generally regular, but also of about the same length; that is, the double movement of a rowing-stroke (the pulling and the feathering) will, in most cases, last just as long as two strides (one with each leg) on the skates. And both the complete rowing-stroke and the double skating-stride will, again, last just as long as an ordinary complete respiration (consisting of inhalation and exhalation). Furthermore, if the time of the movements is accelerated, the harder work of the greater speed will naturally require an exactly corresponding increase in the measure of the respiration, because more air is needed. I think it is impossible to name a third sport or game in which the movements correspond so precisely with a convenient breath. In all other cases the movements are either much quicker or much slower, or quite irregular.

Another resemblance is in the work of the legs: a sudden and energetic pushing away of the body's weight, using the whole flat of the foot as basis. Certainly, in the one case, only one leg is used at a time, in the other, both legs simultaneously. But it is a fact that muscles well trained in one of these sports are highly useful for the other. Further, the big back muscles (latissimus dorsi and erector spinæ) are very much used in rowing and in speed-skating. The lower part of the back is generally the only point where beginners in both sports suffer from swollen and sore muscles. But the consequence is that back-muscles well trained by rowing will much more easily stand the strain of speed-skating, and *vice versâ*.

I have raced in all sorts of boats for over twenty-eight years. For more than ten years I stroked the Scandinavian Champion Fours. I am sure the main reason for our continual success was that I had taught my crew how to breathe while rowing. And, every time we were lying in wait for the signal to start, the last thing I asked my comrades to remember was to breathe deeply both then and also during the first strokes. I presume that our competitors must have held their breath from sheer nervousness during the first five or six strokes, with the result that, before half a minute had passed, they were out of breath, and could not recover it for a few minutes, by which time we had usually got ahead by one or two clear lengths. Besides which I made another rule, in order to be sure that both lungs and heart were in good working order just at the moment of starting. While our competitors were always very careful to economise their strength by paddling out to the starting post, I used to set a rather quick stroke, putting a little more than half power into it. And I always went a few hundred yards past the starting-post before I turned; and we then made one or, if

FIG. 46.

The Author's second son, *Per*, born April 24th, 1903. (Photo, in October, 1913.)

FIG. 47.

The Author's eldest son, *Ib*, born June 2nd, 1899. (Photo, in October, 1913.)

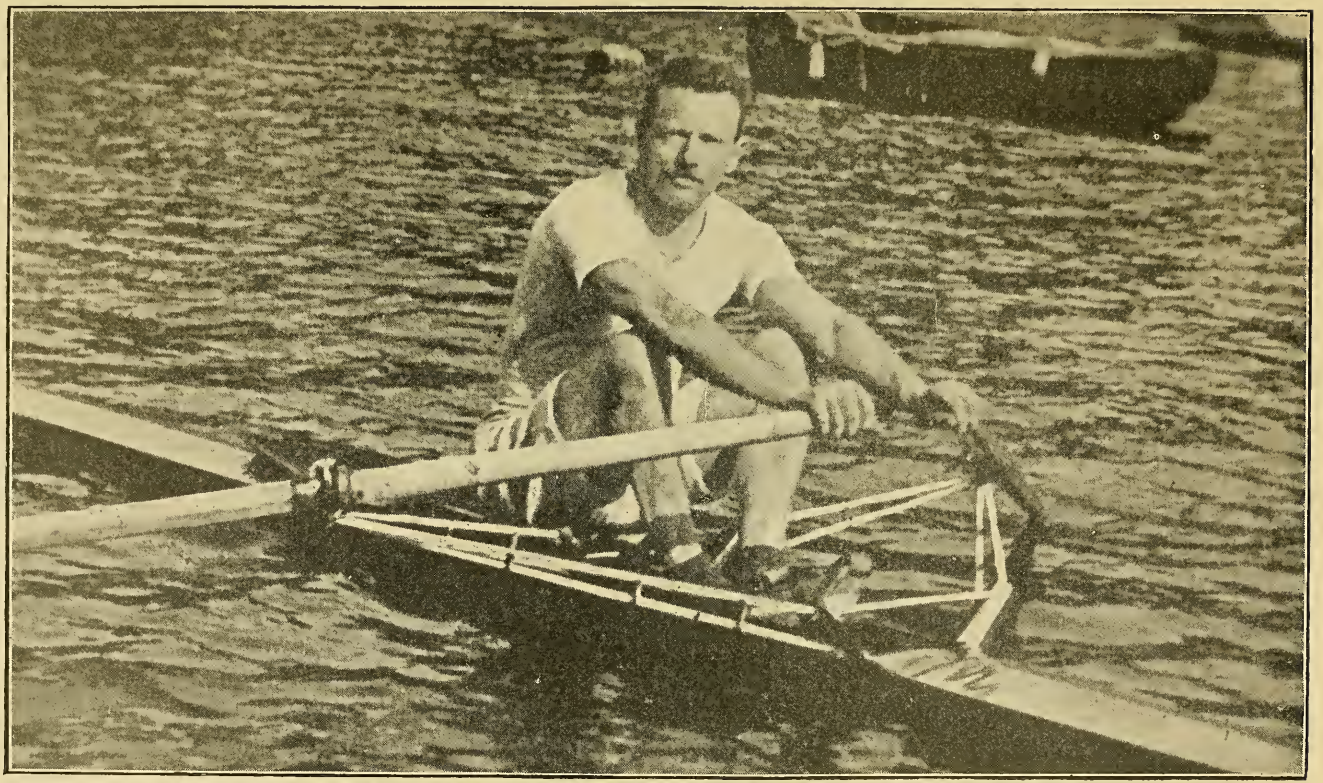


FIG. 48.
The Author sculling on the River Thames.

the first failed, two starts in the direction of the course. Then we rested awhile, preparing ourselves and applying resin to the palms of our hands. I was careful that this rest should not last so long as to deprive our bodies of the warmth and our lungs of the elasticity gained by the smart row to the starting-post. If we were a little too early, I would, therefore, make one more start, only five strokes, of course. These preliminary short starts before the real one, and under the very same conditions of wind or stream, are very useful. I think most rowing athletes have experienced that, when practising starts, the second or the third will always be much more successful than the first. I have only once started as member of a crew of Englishmen. It was in a match for scratch eights on Boxing-day, 1912. We paddled up against a very hard stream, and had to race back with the stream. I, therefore, recommended our stroke, an old Diamond Sculls winner, to make a trial start with the stream. I think it would have proved useful, especially for people who had never before rowed together. But he did not do this, so I suppose it is not the custom here in England.

Now, as to combining the time of the stroke with the measure of respiration, I make it a general rule that only one complete respiration should be taken during a complete stroke (pull and recovery), when the time is slow and no great exertion employed, and also when the time is very quick; whereas two respirations may be taken when full force is used without the stroke being quick. The reason is that the requisite amount of air depends more on the force applied than on the rate of strokes. If a quick stroke lacks energy it will not give so much speed nor cost so much effort as a slow stroke with a more energetic pull. What, in this connection, should be deemed a "quick" or "slow" stroke depends, of course, a good deal on the kind of boat. For instance, in a sculling "best boat" a time of less than 24 may be reckoned as slow, in a "four" the limit would be rather about 28, and in an eight as much as 30 or 32.

Then there is the question of *when* to inhale during the stroke. The main principle should be to perform inhalation when the trunk swings backwards, and exhalation when it bends to the front. Some special styles necessitate small deviations, but the principle is generally correct. The reason is that a free position in the backward swing favours the abdominal part of the full inhalation; while the bent or even crouched position in the forward swing favours the corresponding part of the exhalation. I must admit that I have both seen and heard the exactly opposite method recommended. As an argument, it was propounded that the hard water work was performed during the backward swing, hence it was wrong to inhale simultaneously. It was much better to do it during the easy work of feathering! Of course, I do not agree to this, but I know very well how this misunderstanding arose: I have met scores of athletes and sportsmen who paid attention only to inhalation, scarcely realising the existence of exhalation, which in reality represents—or ought to do—quite as great amount of physical work as inhalation. The above-mentioned simple rule of the distribution of breath in the stroke is illustrated in Fig. 49 and by the

curve A in Fig. 54. It should be applied in light rowing gigs and outriggers (pair-oars, fours and eights), always when the rate of stroke is quick, and also when paddling at a slow pace. But if, in these boats, a hard pull is combined with a slow stroke, an extra inhalation should be taken in the

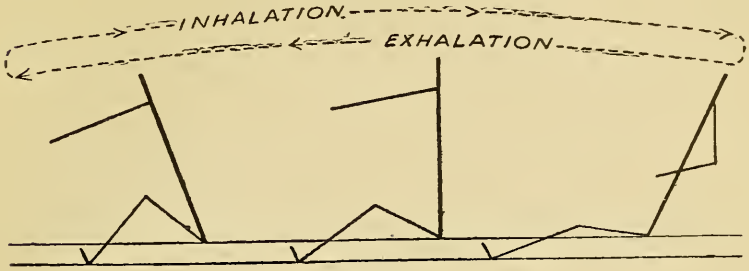


Fig. 49.

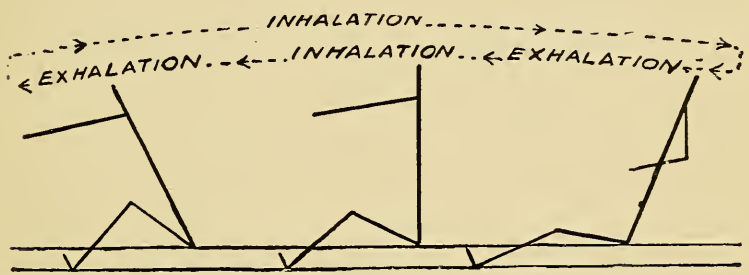


Fig. 50.

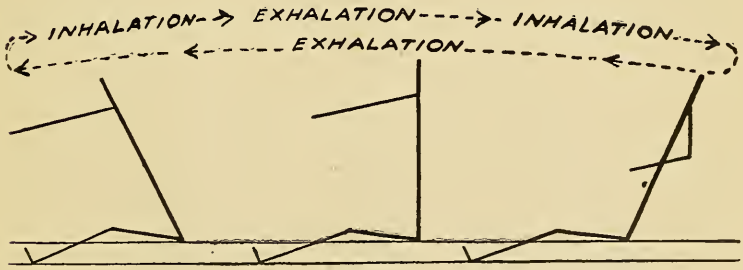


Fig. 51.

middle of the quiet recovery, while, of course, an ordinary inhalation is taken during the short vigorous stroke (see Fig. 50 and curve B of Fig. 54).

In very heavy rowing gigs, and in ordinary broad sculling skiffs with fixed seats, it is also recommended to take two respirations per stroke if full speed is wanted. But here the extra inhalation should be taken during the pull, because this is, by necessity, long and rather slow, while the recovery

is quick (see Fig. 51 and Curve C of Fig. 54). Still other modifications are useful in sculling "best boats" when the modern style is applied (as taught by the best English professionals, Ernest Barry, W. G. East, Bossie Phelps, Bert Lee, Albany, and others). Fig. 52 and curve D of Fig. 54 show the best way of respiring during a quick stroke with hard pulling, and always when paddling. As will be seen, here again, as in Fig. 49 (and curve A), we have only one complete respiration to one stroke with its recovery, but the distribution is different, owing to the special style—of which the most con-

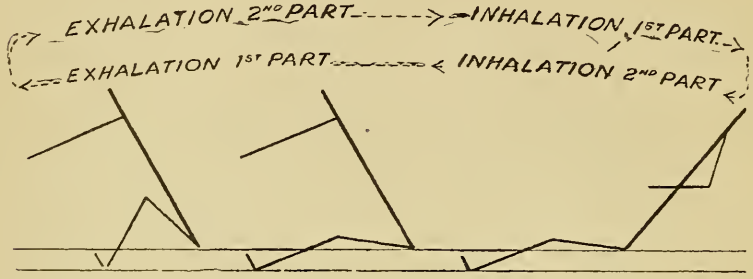


Fig. 52.

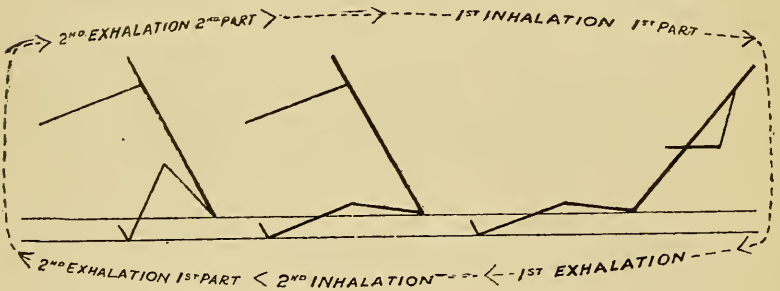


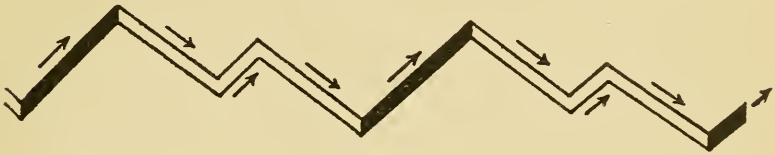
Fig. 53.

spicuous features are that the legs are fully straightened before the trunk is swung back, and that, when feathering, the hands, arms and trunk are successively swung forwards before the seat is moved and the legs folded. (As the matter stands, I will not here give further practical details of this style, nor theoretical arguments for its superiority, because I am not writing a booklet about sculling, but on breathing.) Fig. 53 and curve E show the most correct manner of taking two breaths per stroke when this sculling style is combined with a slow rate of stroke, but with full force. The next best method—and much easier to learn—would here be to take one complete breath during the pulling and one during the feathering (see curve F of Fig. 54). All these directions seem, perhaps, somewhat circumstantial. But I assure you that each method is acquired with a week's practice, and

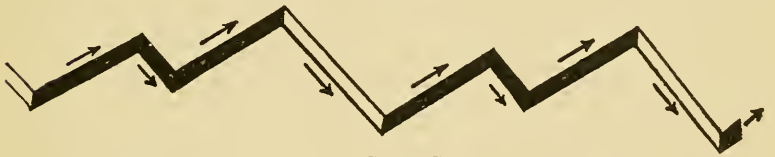
PULL IN WATER ← Arrows pointing upwards—Inhalation.

FEATHERING ← " " downwards—Exhalation.

Curve A.



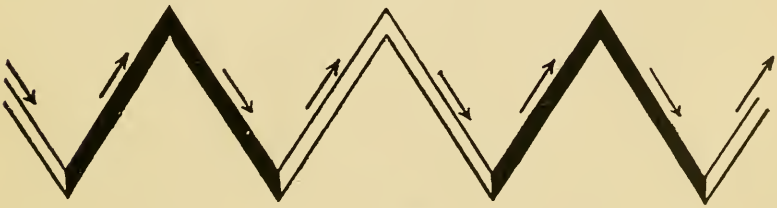
Curve B.



Curve C.

Curve D.

Curve E.



Curve F.

FIG. 54.

afterwards performed quite subconsciously. And please remember that a regular, correct respiration signifies less waste of energy and, therefore, greater stamina.

The air should, of course, as far as possible be drawn through the nose alone. The Albar apparatus may be of good use, if not so serviceable as in long-distance running, because, when the hands are engaged with the oar or sculls, it is not easy to refix the apparatus should it get out of position, which occasionally happens.

CHAPTER II.

HINTS FOR SINGERS AND SPEAKERS.

Singing and speaking are in a great measure physical work. It is, therefore, obvious that the sounder and better developed the physique is, the more advantageous will be the conditions for good singing and speaking. And it is a matter of course that it is the strength and endurance of the organs directly engaged during singing and speaking which is of the greatest importance. Now, the air exhaled from the lungs being the productive agent of the voice, it is clear that the lungs ought to be well-developed before singing is attempted. And the abdominal muscles being the most important factor in controlling exhalation, and therewith the voice, all vocalists ought particularly to develop the strength, endurance and mobility of these muscles. It is no wonder that most singing masters on the Continent recommend—some masters even exact—that their pupils should perform "My System" (15 Minutes' Daily Exercise), because they know by experience that it is the best existing means of strengthening the abdominal muscles. The exhaled air, controlled by strong and braced abdominal muscles, can then be utilised at will for the sustaining of a very prolonged note, which can be kept at the same level of pitch and tone, or made to swell or diminish according to requirements.

The lungs are also highly developed by "My System," and especially by the "Breathing System" explained in the present booklet. All would-be singers and speakers ought, therefore, to practice it. My methods will be found invaluable from the point of view of increasing the range of extensibility of the muscles of inspiration, thus rendering the chest more flexible. The vital capacity does not depend upon the size of the chest, but upon the mobility of the chest walls and the elasticity of the lungs, which are greatly increased by my free and breathing exercises, and also by good sports (such as rowing), when performed with strict attention to proper breathing. It is the difference between the circumference of the chest after a full inspiration and after a deep exhalation which tells. I have met some of the "strongest" weight-lifters in the world, who have yet died when about forty years of age. They had a chest measurement of about 50 inches, but an expansion of only ¾ or 1 inch, whereas several famous singers or first-class rowing men could show an expansion of 10 inches, even if their greatest chest circumference be only 45 inches.

I have perused scores of English and German manuals on "The Art of Breathing for Voice Production," or under similar titles. One advocated special abdominal breathing; another only clavicular breathing; a third, a lateral costal method; a fourth, respiration with the back; a fifth, a hysterical female singing teacher, recommends deep sighs! and so on. All

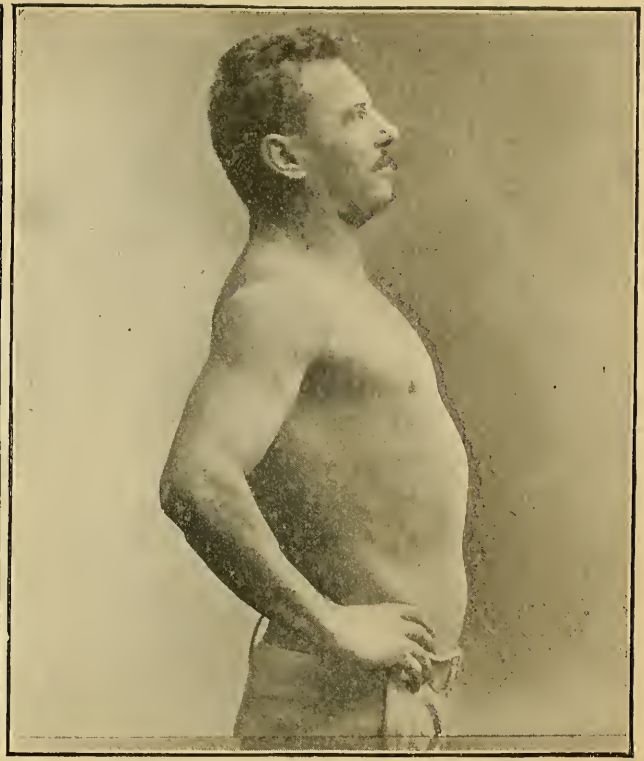


FIG. 55. FIG. 56.

Showing the abdominal wall being braced, but not drawn in, immediately after inhalation.

of which is nonsensical, and must have done a great amount of harm, directly or indirectly, by preventing students from learning a good method. Even the London County Council's "Syllabus of Graduated Instruction in Singing" is full of errors. Strange to tell, the only commonsense hints I ever read about this matter are those given by a clergyman, namely, the Rev. Chas. Gib,[1] principal of the institute for teaching the "Gib System of Vocal Training and Expression," 10, Hugh Street, Eccleston Square, S. W.

It is obvious that, the more thoroughly the lungs, to begin with, are filled with air, the greater the potential productive power of the voice will be, and the longer and stronger the note produced. The best way of inhaling while singing is that prescribed in "my complete breath," with the exception that it must always be performed quickly and through the mouth, and, further, it is, of course, not always possible to rest the hands on the hips (which position makes the raising of shoulders and upper chest easier). The reason why the full breath must here be inhaled through the mouth is not only that it can thus be performed very quickly, which is often necessary, but it is really a mistake to inhale through the nose whilst singing, because the back of the tongue will then rise and partly close the throat, and the note produced will take a nasal twang.

Exhalation, on the other hand, is, of course, performed quite otherwise than in "my complete breath." The elastic force of the expanded and elevated chest should be held in check by the contracted, or rather braced, abdominal muscles. Certainly it is impossible to prevent the ribs from sinking somewhat at the moment when the abdominal muscles are contracted. But after this the chest should be allowed to sink only gradually, and the volume of air in the lungs can thus be controlled at will by the momentary relaxation of the abdominal muscles, and can be emitted quickly or slowly, forcibly or gently. Fig. 55 gives a front view and Fig. 56 a side view of the right pose immediately after completed inhalation. The abdominal wall is very slightly retracted, the muscles being only braced, not drawn inwards, and the lower ribs fixed. I will take this opportunity of pointing out that "drawing in" and "bracing" of the abdominal wall are two quite different things. This wall may be voluntarily either relaxed or braced in any position between the fully distended and the completely retracted.

It is, of course, important not to let the air escape all at once. If the air is to be economised, compression must be continuous, and, until the student has learnt how to do this automatically, he will never become a good singer or speaker.

This method was used by the old Italian singing masters for more than 150 years. But in 1855 it was rejected by the French author, Mandl, who, in England, was followed by Lennox, Browne and Behnke. Mandl recommended the abdominal method of breathing, in that he maintained that the

[1] Author of "Vocal Science and Art," and "The Art of Vocal Expression."—William Reeves, London, W.C.

distending of the abdomen would facilitate the "flattening" of the diaphragm and thereby increase the capacity of the lungs.

After all, I am sure that the old Italians were right, only their method has been misunderstood. I do not think that they advocated contraction of the abdominal wall *during* inhalation. It is more likely than not that they advised contraction only *immediately after* inhalation. Personal practice will show to anyone that it is quite possible to brace the abdominal muscles after a complete inhalation, letting the ribs sink a little, and even to retract the abdominal wall considerably without letting the slightest amount of air escape. It will only be compressed, but that is just what is necessary for the production of a good note—that the pressure of the inside air is stronger than the atmospherical pressure. When the right moment arrives, the glottis opens, and the sound produced is louder on account of the greater density of the air, owing to its compression.

It is impossible to over-estimate the importance of attacking the vowel sounds easily and accurately. This is best accomplished when:—

(1) The glottis is first quietly, not tightly, closed, so that no air can escape. Hence air is not wasted, but converted into sound.

(2) The air is compressed below the vocal cords.

This compression of the air gives volume and intensity to the voice. Compression means economy and control of breath.

Students will do well to remember that this volume, intensity, economy and control are not obtained if the vocal cords approximate when inspiration has already begun; for this attack, to use the current expression, "on the breath," means vocalising on a column of improperly compressed air.

(3) When the vibrations are to be begun the muscles should be relaxed to the requisite degree; this is a point that needs carefully thinking out and applying.

(4) At the critical moment the vocal cords are gently parted asunder, and the air is released. In this way a "neat articulation of the glottis" can be acquired, that gives a precise and clean start to a sound, and enables a singer, as Manuel Garcia put it, "to pitch the sound at once on the note itself, and not to slur up to it or feel for it."

All singers and speakers who desire to be heard at a distance should employ this method of attack.

No cough or straining is excited, and no jerking with the abdominal muscles must be permitted.

Perfection in this most important and fundamental exercise is attained when it can be performed with the most gentle and delicate precision, in fact, when the attack is produced automatically.

On January 15th, 1910, a conference was held at the University of London, and a sub-committee was appointed to inquire into the present-day knowledge of the voice and speech training, in order to ascertain the scientific basis upon which speech training should be conducted, and what agreement exists in first principles.

The sub-committee undertook to investigate normal healthy breathing

in relation to speech. With consent of Dr. Pasteur, who acted as chairman on the sub-committee, the report is published in the *British Medical Journal* of August 30th; the reason given for its publication being its likelihood to be of interest to medical men, teachers, and other persons.

The committee appear to have taken great pains to describe ideal breathing for the voice; and add that such ideal breathing should bring every part of the lungs into activity.

But, unfortunately, the method of breathing advocated by the committee makes it a physical impossibility to bring every part of the lungs into activity.

For, if there is to be a full inflation of the lungs, the chest must be fully expanded in its three diameters; but if there is to be—as the committee suggest—"the hardening of the abdominal walls which checks the outward bulging," it is impossible to expand the lower ribs. There must be no "check," no "hardening nor any drawing inwards of the abdominal wall," if the lungs are to be inflated at their bases, which is most important, as the lungs are broadest here. The correct method of breathing when the best vocal effects are desired, to say nothing about healthy breathing, is the concerted and harmonious action of all, and not part, of the respiratory mechanism.

It is admitted on all sides that consumption is associated with all forms of poor breathing, and it is a terrible thing to contemplate that inadequate methods of breathing are daily being taught in our schools; and especially so when one generation of correct breathers would reduce consumption to a minimum.

It wearies and sickens one to think that the great masses of humanity are cut off, in early childhood and ripe manhood, by a disease which can be minimised if the whole mechanism of respiration were employed. Close observation and long experience have proved to me that the majority of my fellow-men breathe superficially.

Just in order to counter-balance the eventual damage caused by mouth-breathing during singing, it is for vocalists of the highest importance that they acquire the habit of exclusive nasal breathing during physical exercises, and always in daily life when they are not cultivating their talent.

Finally, I think it would be beneficial to say something about damaged voices, their restoration and development.

Medical authorities are constantly telling us that many throat troubles are due rather to improper production of the voice than to actual over-use of the vocal organs. This statement is fully substantiated by damaged voices heard in pulpits, at the Bar, on the stage, on concert and speaking platforms, and amongst choristers.

I may also mention the cases of Mr. Lloyd George and Sir Edward Carson, both of whom at the time of writing have had to retire from their political duties to rest their injured voices. But perhaps my readers will not thank me for advising them as to the proper care of their vocal organs; there are many who are of opinion that we hear enough of politicians as it is,

and that to be the means of helping them to give even greater performances of oratorical effort will be to inflict injury on a long-suffering public.

The usual treatment prescribed for the damaged voice is rest, which results only in temporary improvement. The real remedy is the restoration and development of the fundamental conditions of voice, namely, the sympathetic co-ordination of breathing with a simultaneous passivity and opening of the throat. The presence of these conditions means ease and naturalness; the absence of them, constriction. The mastery of this fundamental co-ordination must be the first step towards the restoration of the voice. "Nasal twang," "throatiness," the vicious vibrato, can only be eradicated by sympathetic relaxation of the tone passage, co-ordinated by breath control. We must all admit that the human voice is not a machine, but forms part of our own organism. Man is a trinity, and the true method of restoring and developing the voice recognises this triple unity. For it cannot be denied that our voices are dependent on the body, and that body and the voice depend upon the actions of the mind. Any attempt to restore the damaged voice on a purely physiological basis is to court failure; the most technical exercise should be made as psychical as possible; and in singing vocal exercises the faculty of imagination and feeling should be aroused. It is never wise to draw too much attention to faults, this tends to deepen self-consciousness, and delay the restoration of normal conditions. In the case of singers who have "breaks" in their voices, as well as with those who suffer from impediments of speech, it is well, by suggestion, to take the mind away from the seat of the trouble.

Damaged Voices.

The Rev. Chas. Gib has for years been making observations of voices damaged by misuse. Let me quote a few lines from a lecture given recently by him:—

"Every kind of damaged voice has come under my notice. 'Ministerial Tunes,' robed in mediæval darkness. 'Neurotic breaks,' 'vibrato,' common as pebbles on the seashore, stammerers and stutterers, and a host of others which it would not be right to mention. In addition to this, I have been much helped by going unperverted to Nature and to the training of boys' voices, and also studying the boy's voice and developing it during the transition period. It is this latter study that enables the student to observe how the voice buds and then blossoms. No one with a damaged voice should attempt to improve his voice, be he speaker, singer, or stammerer, unless he has first learnt the art of relaxation, coupled with correct breathing. It may be well briefly to state the reasons why considerable stress should be laid upon this unique preliminary to voice production.

"Every grown-up person is more or less highly tensed, and, in cases where voices have gone wrong, physical as well as mental tension is very marked.

"Speaking of our muscular system, our muscles are often strung to a higher pitch than is necessary to accomplish their work.

"For the easy emission of the voice it is not only unnecessary, but actually defeats the object in view, when not only the muscles of the larynx, but all the rest of the muscles in the body are rigid and overdeveloped.

"The object of practising muscular relaxation is to get rid of excess of tension, which is a hindrance to correct breathing, and hence to voice emission, so as to place the whole mind and body in such a passive condition that the pupil is at once fully receptive to outside impressions, and, at the same time, capable in the highest degree of responding even to considerable and lengthy demands upon his vocal mechanism without undue fatigue."

Conclusion.

I have come regretfully to this paragraph, because there is so much on this all-important subject of breathing that I have been compelled to leave unsaid. Correct breathing is as necessary to promote and preserve good health as is proper attention to diet and to exercise. I am inclined to urge that it is even more necessary, for the evils of improper diet are not so far-reaching in results as those of incorrect breathing. As I have already pointed out in my first chapter, we may go without food for days and thrive, but the aëration of the blood is so essential to life that if stopped entirely for but a few minutes, death is the result. This fact is obvious, and known to all; but only a few really appreciate the injurious, even fatal, effects of the imperfect aëration of the blood to which so many thousands are continuously exposed, not only those who live in contaminated atmospheres in large cities and congested districts, but also those who live in the pure air of the countryside, but who do not know how to breathe properly.

It is enough to say that if the vital fluid—the blood—be never fully purified, it cannot carry out the life-preserving task which is allotted to it; it is itself impure, and instead of coming to the rescue of the tissues in their fight against the germs of disease which shorten life, it brings to these germs nourishment which aids them to multiply and establish themselves in the body which in time they *must* destroy.

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